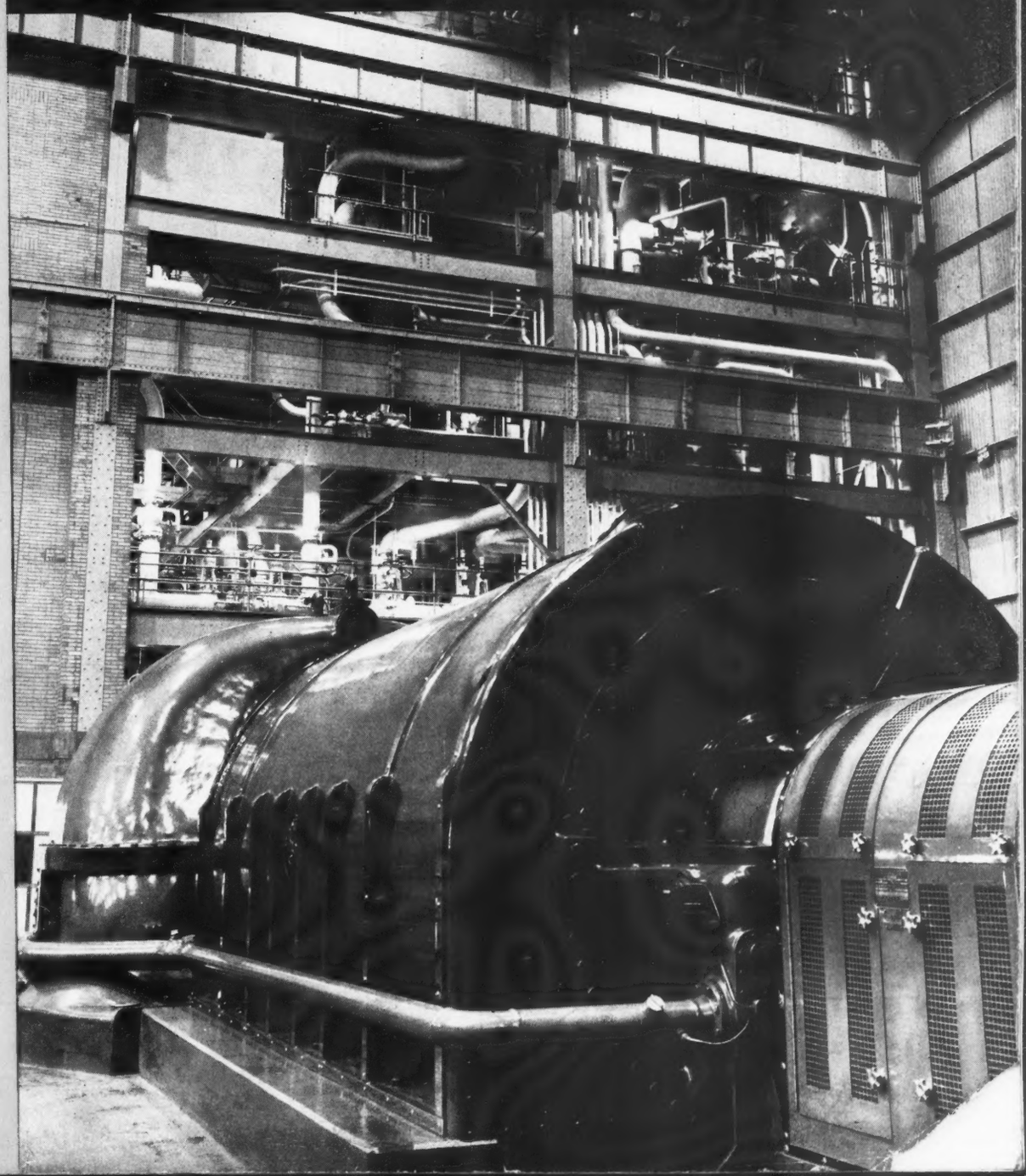
POWER

POWER GENERATION, TRANSMISSION, APPLICATION
AND THE ATTENDANT SERVICES IN ALL INDUSTRIES



CTOBER, 1942

vert from oil to coal — a must industrials, to ease Atlantic ast transportation. These case dies detail typical change-ers. Story starts on page 66

rbocharging diesels increases put of existing 4-cycle units. w Buchi supercharging system rks. See page 78

rtime Power Clinic — Practical wer men solve emergency war oblems. Begins page 101

chines must work for war — or scrapped. Here's how one oup salvaged tons of vital aterials by a thorough plant eckup. Details on page 93

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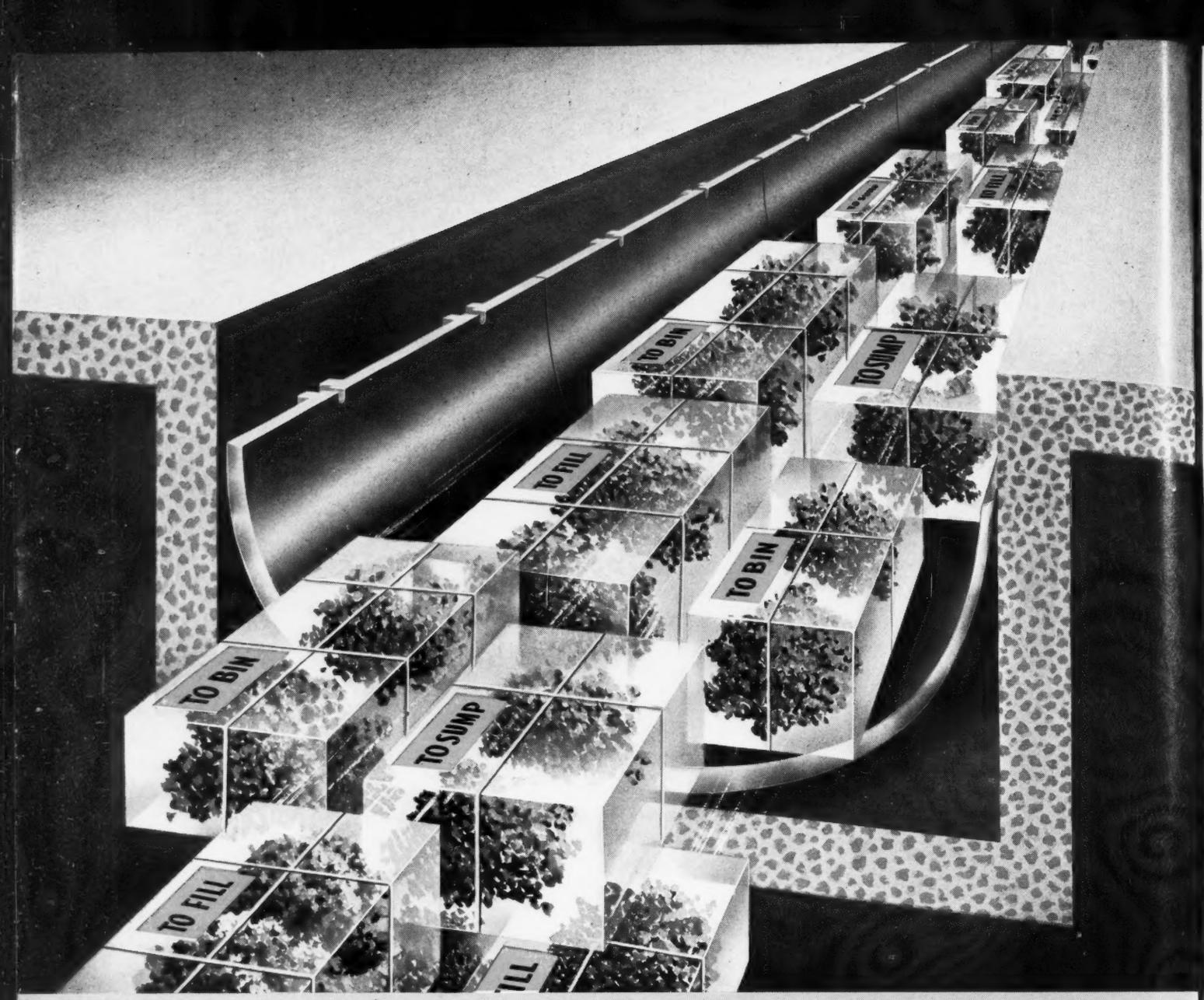
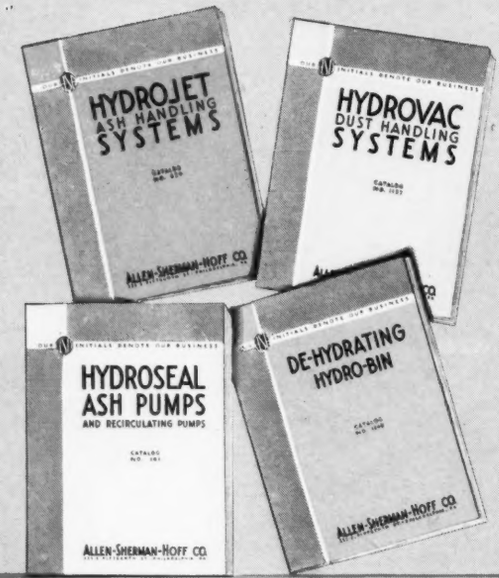


Ashes Wrapped in Water

Delivered Anywhere



Cleanliness is doubly sure with the Hydrojet System for the ashes and dust cannot escape from the water and the water cannot escape from the system. Ashes are enveloped by water before they leave the totally enclosed hopper of the Hydrojet System. They flow into the sluiceway beneath the floor, where high velocity water streams convey the ash directly to a permanent fill, temporary fill or dehydrating grab bucket sump. Alternately, the sluiceway delivers them to a small transfer sump, from which they are pumped by a Hydroseal Ash Pump to a dehydrating bin, permanent fill, temporary fill or a dehydrating sump, thence clamshelled to a railroad car or truck, sufficiently wet so that there is no dust.

ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA • *Offices & Representatives in Principal Cities*

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), October, 1942, Vol. 86, No. 10. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office 99-129 North Broadway, Albany, N. Y. EDITORIAL AND EXECUTIVE OFFICES, 330 WEST 42ND STREET, NEW YORK, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, 35c per copy.

ROLL Your Cars Over to Unload and Keep 'Em Moving

The LINK-BELT Rotary R. R. Car Dumper Unloads up to 30 Cars per Hour

The many Link-Belt rotary railroad car dumpers now in service, are playing an important role in the battle of transportation. This unit is capable of unloading all types of open-top railroad cars—varying from 26 ft. to 60 ft. long; 7 ft. to 12½ ft. high; 8½ ft. to 11 ft. wide; and with capacities up to 120 tons. The number of cars it can handle in a given time depends upon the switching and track facilities for supplying loaded cars and removing empties. A full cycle of dumping and returning to normal position is accomplished in 1½ minutes. The whole operation is so simple, automatic and foolproof that unskilled labor can perform it readily; it is completely under control at all times and can be stopped instantly at any point of the cycle. Send for Book No. 1004.

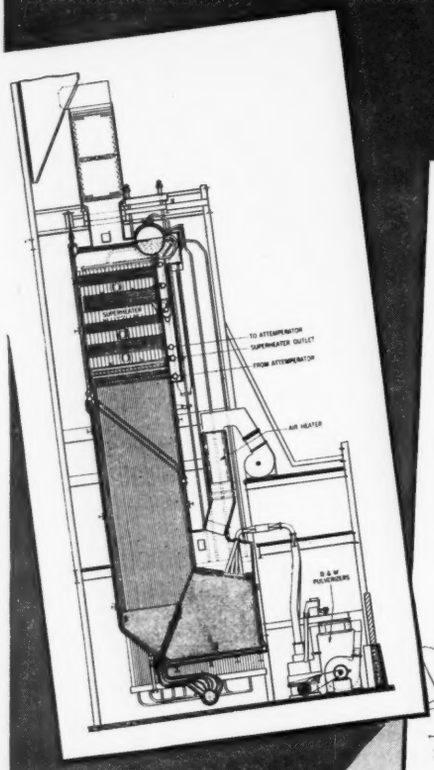
LINK-BELT COMPANY

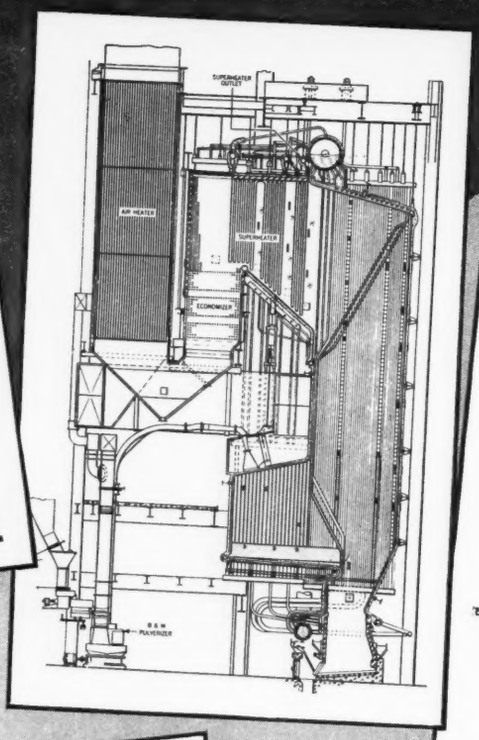
Chicago Indianapolis Philadelphia Atlanta Dallas San Francisco Toronto

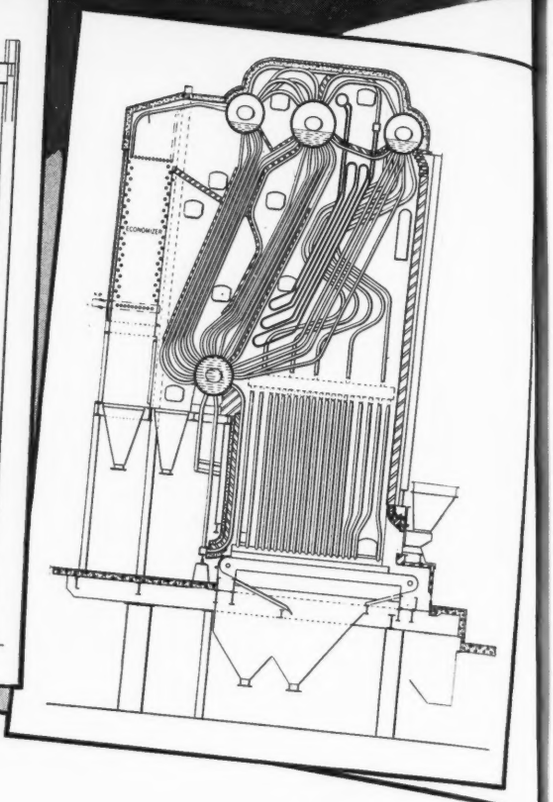
Offices, warehouses and distributors in principal cities.

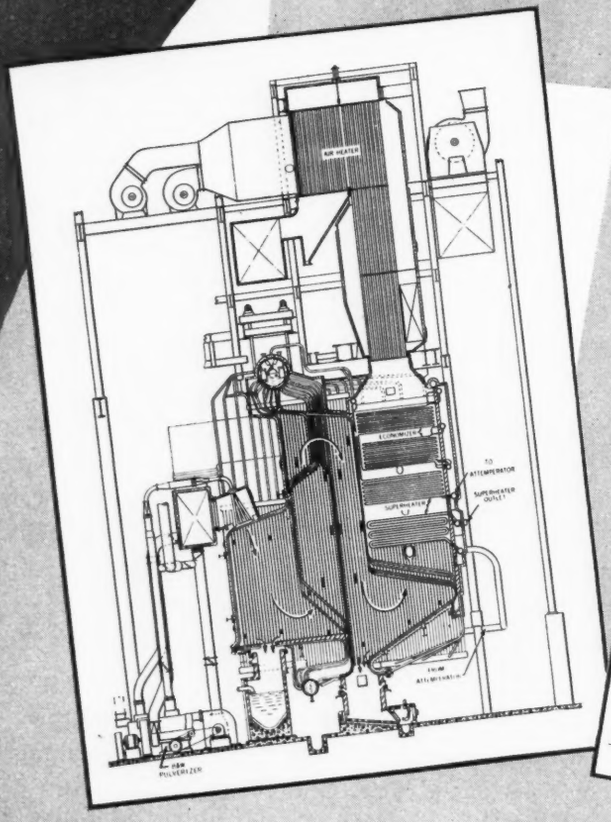
8924-C

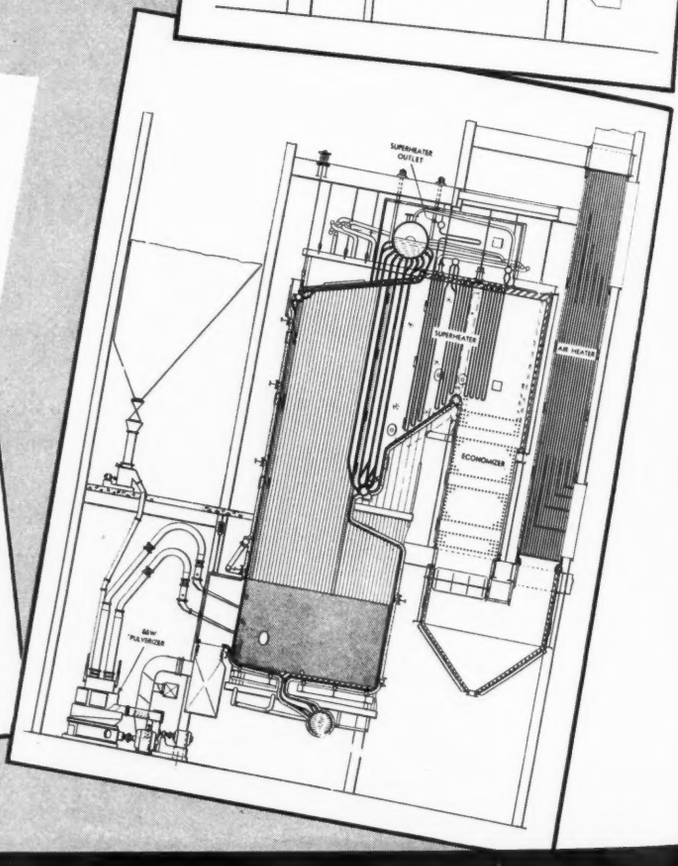
B & W Designs m











BABCOCK & WILCOX W

s meet all Requirements

of modern water-cooled furnaces

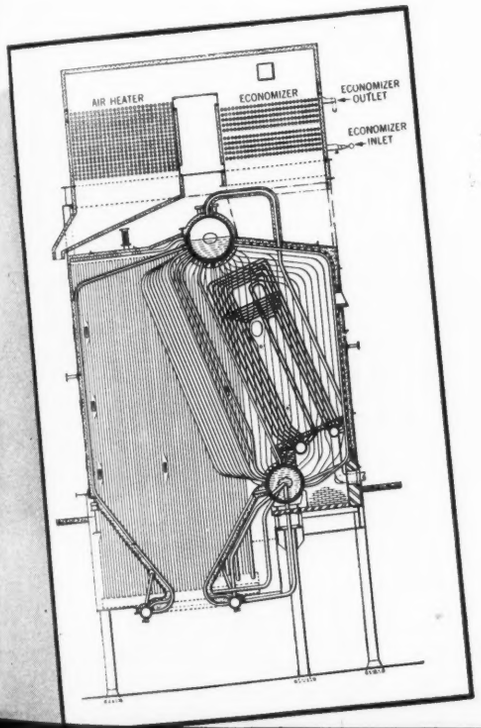
Water cooling must not only operate under a wide range of load and structural conditions (as illustrated by the typical settings shown) but also must serve many entirely different purposes in individual boiler furnaces.

Some areas of water-cooled furnaces are designed to promote combustion—others, to temper gases. Frequently heat input must be limited—sometimes radiant heat must be absorbed rapidly. Some constructions must facilitate removal of ash in liquid form—others must condition ash for ease of removal in the dry state.

Obviously no single type of water-cooled construction can be used successfully for all present-day boiler-furnace conditions and purposes.

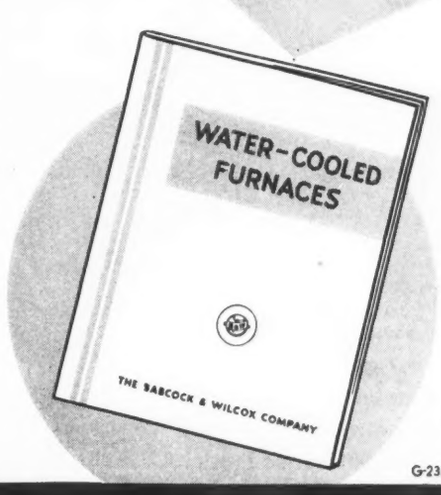
B&W water-cooled furnace constructions have the diversity necessary for meeting all these demands and their range of applications is sufficiently broad to fit every requirement. Fundamental details and safety factors necessary to proper operation and efficiency are common to each type.

The Babcock & Wilcox Company — 85 Liberty St., New York, N. Y.



This booklet upon request

We will gladly send you a copy of Bulletin G-16, Water-Cooled Furnaces. It shows many typical boiler furnace designs; illustrates seals, wall supports, headers, studded tubes, and other features; tells of important requirements for water cooling; describes typical constructions.



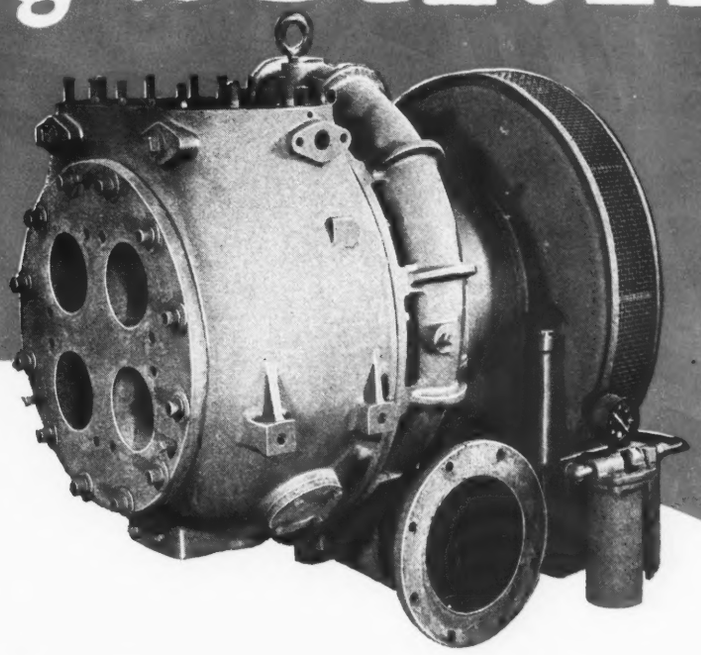
G-233-T

K WATER-COOLED FURNACES

Something sensational is h

Above is shown how the Elliott-Buchi exhaust gas turbocharger is normally mounted on a representative Diesel. The engine in the photo is an Enterprise model DMG-36 full Diesel, direct reversible, marine propulsion engine.

is happening to DIESELS!



with

TURBOCHARGING of 4-Cycle Diesel Engines

UP TO 50% MORE B. HP. without increasing engine size . . . and IMPORTANT FUEL SAVING at all loads — up to 25% at ¼ load. This is what Elliott-Buchi turbochargers are doing for Diesels in the stationary, marine, and locomotive fields. The above figures are based upon over two million b.hp. of Diesels now equipped with the Buchi system. They admit of no question.

The turbocharger is driven by the engine exhaust (normally wasted power). The engine load (the volume of exhaust) automatically regulates the speed of the turbocharger and thus controls the volume of air supplied to the engine. No other controls required. In the locomotive and marine field it is important to note that engine reversal does not mean reversal of the turbocharger, since the exhaust flow is unidirectional.

Elliott-Buchi turbochargers are built for turbocharged 4-cycle engine ratings above 250 hp. They can be applied with savings to existing Diesels, but naturally achieve best results in Diesels designed for turbocharging.

We are glad to answer your specific questions on turbocharging, with complete data. Write us.

Hundreds of Elliott-Buchi turbochargers are now being built for the U. S. Navy and other war services

M-56

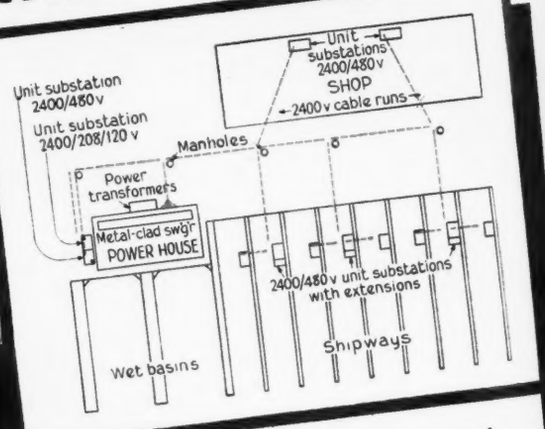
ELLIOTT COMPANY

Supercharger Dept., JEANNETTE, PA.

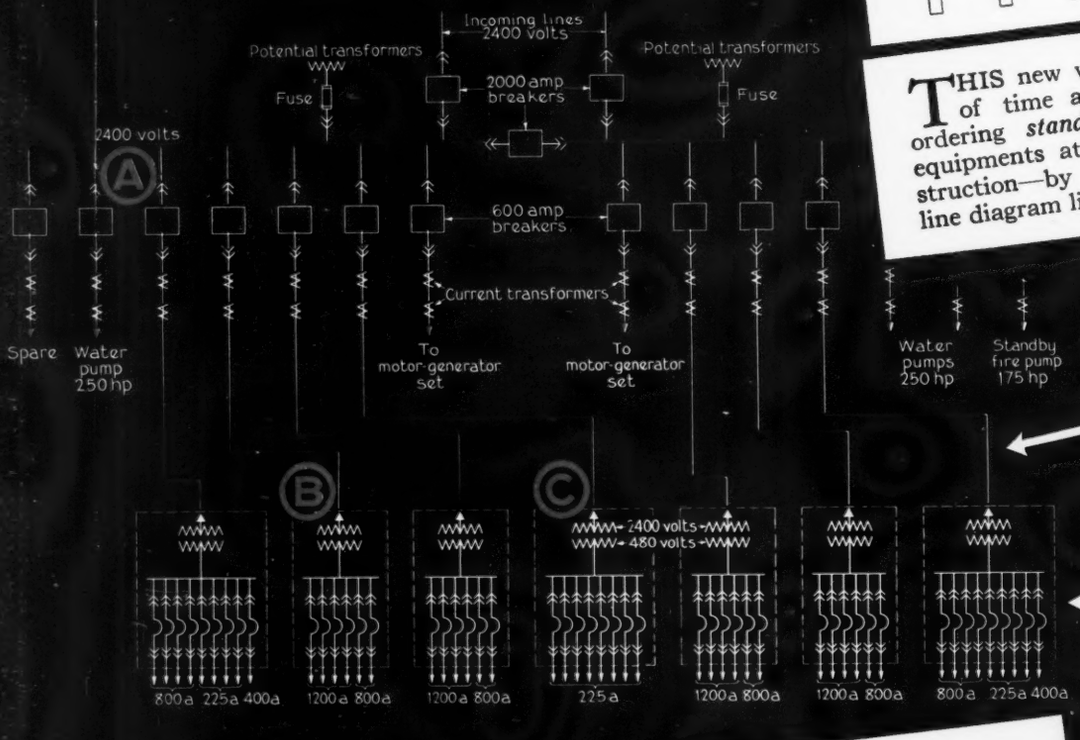
DISTRICT OFFICES IN PRINCIPAL CITIES

1/4 THE TIME 1/7 THE COPPER

AND A BETTER ELECTRIC POWER SYSTEM



THIS new war plant saved months of time and tons of copper by ordering *standard* power distribution equipments at an early stage of construction—by means of a simple one-line diagram like that below.



Power is distributed at high voltage right to unit substations at the load centers—

—from where it is distributed at 480 volts directly to the loads.

Many war-production factories are ordering plant distribution equipments at an early stage of construction by taking these three simple steps:

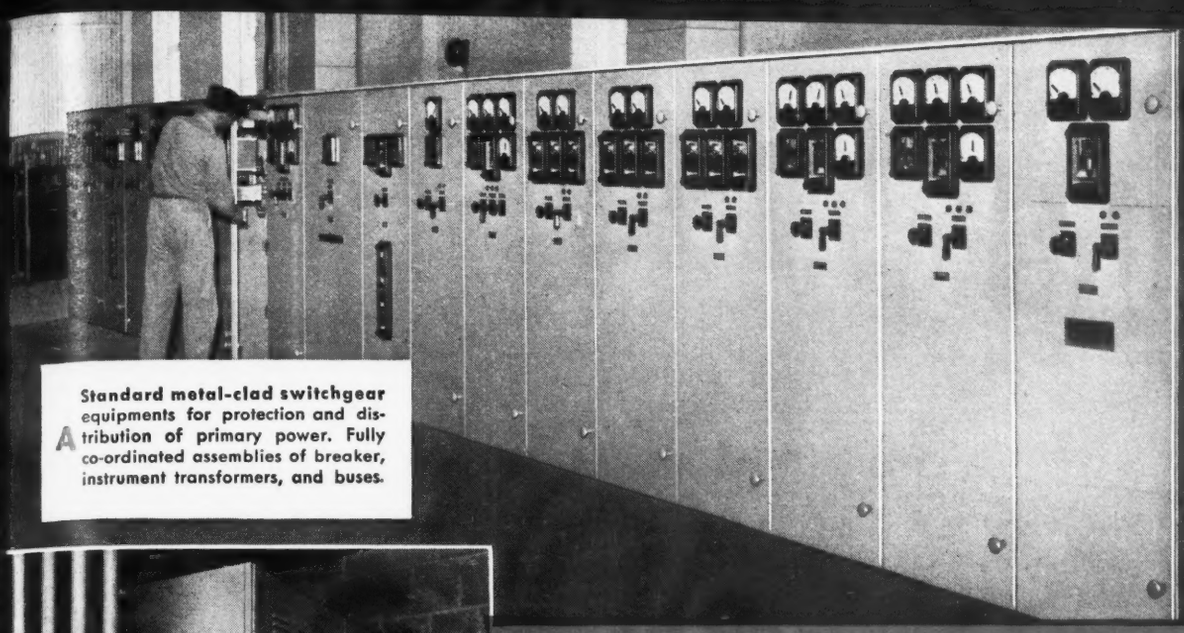
1 *Calculate the total kva you need.* Your consulting engineer can help you to determine this accurately.

2 *Divide the load area into separate load zones of 500, 750, or 1000 kva each.*

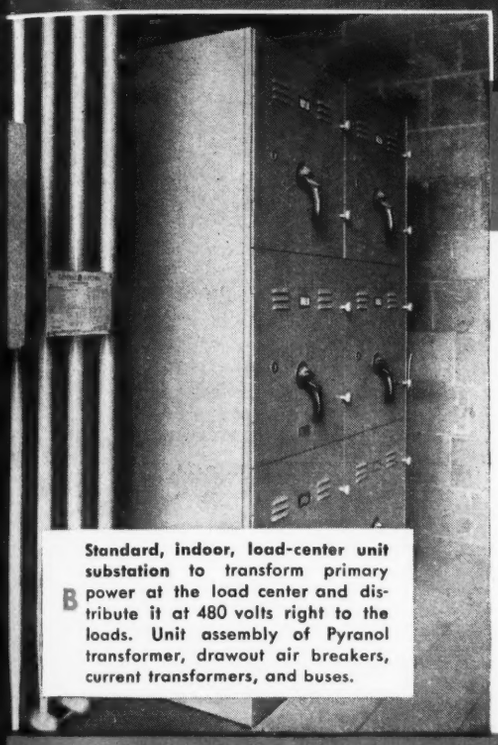
3 *Divide the load of each zone into feeder loads,* and draw a one-line diagram of your proposed load-center system, giving the functions to be performed and the ratings required. *With this one-line diagram you can immediately order standard G-E switchgear equipments and unit substations.*

For further aid, ask for our new bulletin, No. GED-1006.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.



A Standard metal-clad switchgear equipments for protection and distribution of primary power. Fully co-ordinated assemblies of breaker, instrument transformers, and buses.



B Standard, indoor, load-center unit substation to transform primary power at the load center and distribute it at 480 volts right to the loads. Unit assembly of Pyranol transformer, drawout air breakers, current transformers, and buses.

MONTHS SAVED BY ORDERING STANDARD EQUIPMENTS

STANDARD G-E load-center power units were ordered for this war plant soon after construction started. A simple one-line diagram like that at the left put our factory right to work. Metal-clad switchgear and unit substations were installed in *one-fourth* the time needed for non-standard, piecemeal assemblies. They were received at the job when needed—all ready to be set in place and connected.

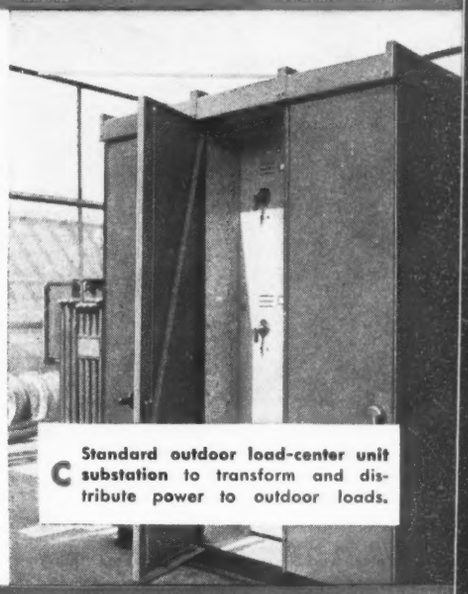
On this page are views of a few of these standard equipments—installed. They are typical of G-E load-center equipments that are being installed quickly and easily in plants everywhere. Note the metal-enclosed construction that safeguards workmen and production.

SAVED 145 TONS OF COPPER WITH LOAD-CENTER POWER DISTRIBUTION

ENGINEERS for this new war plant saved 145 tons of cable copper by taking high-voltage power right to the load centers, as shown at the left. In addition, they got a power distribution system that was so safe and efficient that, when need for additional capacity suddenly arose, they ordered another, a *duplicate* system—and saved another 145 tons of copper.

What's more, it took less copper to *build* these standard metal-clad units. The switchgear equipments shown at the top of this page took but 47 pounds of copper each. An open-type, piece-meal assembly would have taken more than four times as much.

If you need electric power for a new, enlarged, or converted war plant, we know you'll be pleased to learn how much copper and other critical materials you can save by using these standard load-center equipments. You'll find, too, that you can get them on the job quickly, and obtain a new high degree of safety and operating dependability. The nearest G-E office is ready to help you. *General Electric, Schenectady, New York.*



C Standard outdoor load-center unit substation to transform and distribute power to outdoor loads.

GENERAL ELECTRIC

TWO SURE SIGNS OF A

DIAMOND G9B SOOT BLOWERS

Overwhelming Preference for DIAMOND SOOT BLOWERS *Based on* Definite Points of Superiority

More than 80% of all the soot blowers in modern power plants are Diamond Soot Blowers. This overwhelming preference is based upon definite points of superiority, among which are:

SERVICE POLICY

Every installation of Diamond Soot Blowers in water tube boilers is regularly inspected and adjusted, unsolicited and without charge. Reports show this exclusive Diamond Service annually saves many thousands of dollars for users.

FLEXIBLE ELEMENT CONNECTION

Makes the element self-adjusting to movement of boiler tubes or boiler walls.

WELDED BEARINGS

Do not slip or burn—protect blower elements against excessive strain which causes warpage, breakage or misalignment of nozzles.

STEAM SAVINGS

Designed to eliminate steam waste and minimize time of operation. Tests prove they require 50% less steam than cheaper blowers under average operating conditions.

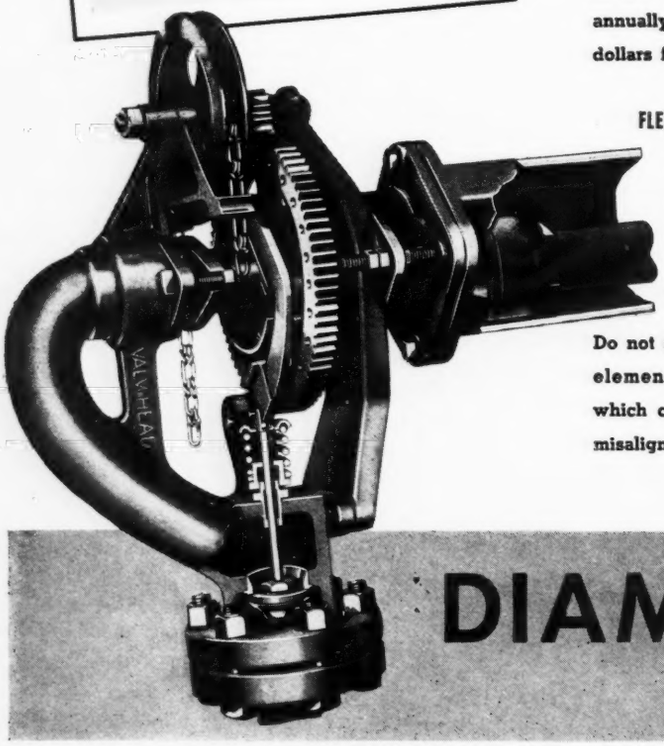
DIALOY ELEMENTS

Wrought seamless high chromium content steel; hard and tough to resist thermal shock and scouring action.

CALORIZED ELEMENTS

The heavy iron aluminum alloy (both inside and outside element) is remarkably resistant to heat and hot sulphur gases.

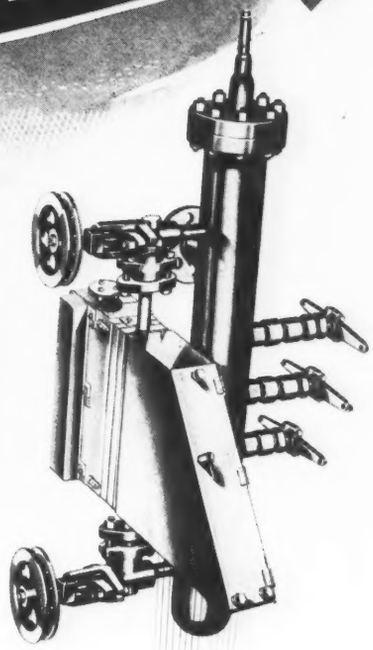
Write for Bulletin No. 884-A



DIAMOND POWER

MODERN POWER PLANT

DIAMOND BI-COLOR WATER GAUGES



DIAMOND BI-COLOR WATER GAUGE *Eliminates* GAUGE GUESSING

The Diamond Bi-Color Water Gauge eliminates "guessing" the water level . . . by bringing the water gauge reading in sharp contrasting colors to the firing floor . . . right under the operator's eye. He reads the *actual* gauge level—illuminated and projected by mirrors from the gauge on the boiler drum.

The Bi-Color Gauge uses the simple optical principle of the difference in refraction (or bending) of light rays when projected through water and through steam. *Water always shows green—steam always shows red* in the Bi-Color. The contrasting image is so clear and sharp it can be mirrored to the instrument panel from any height—through as many as three grating floors without the slightest confusion.

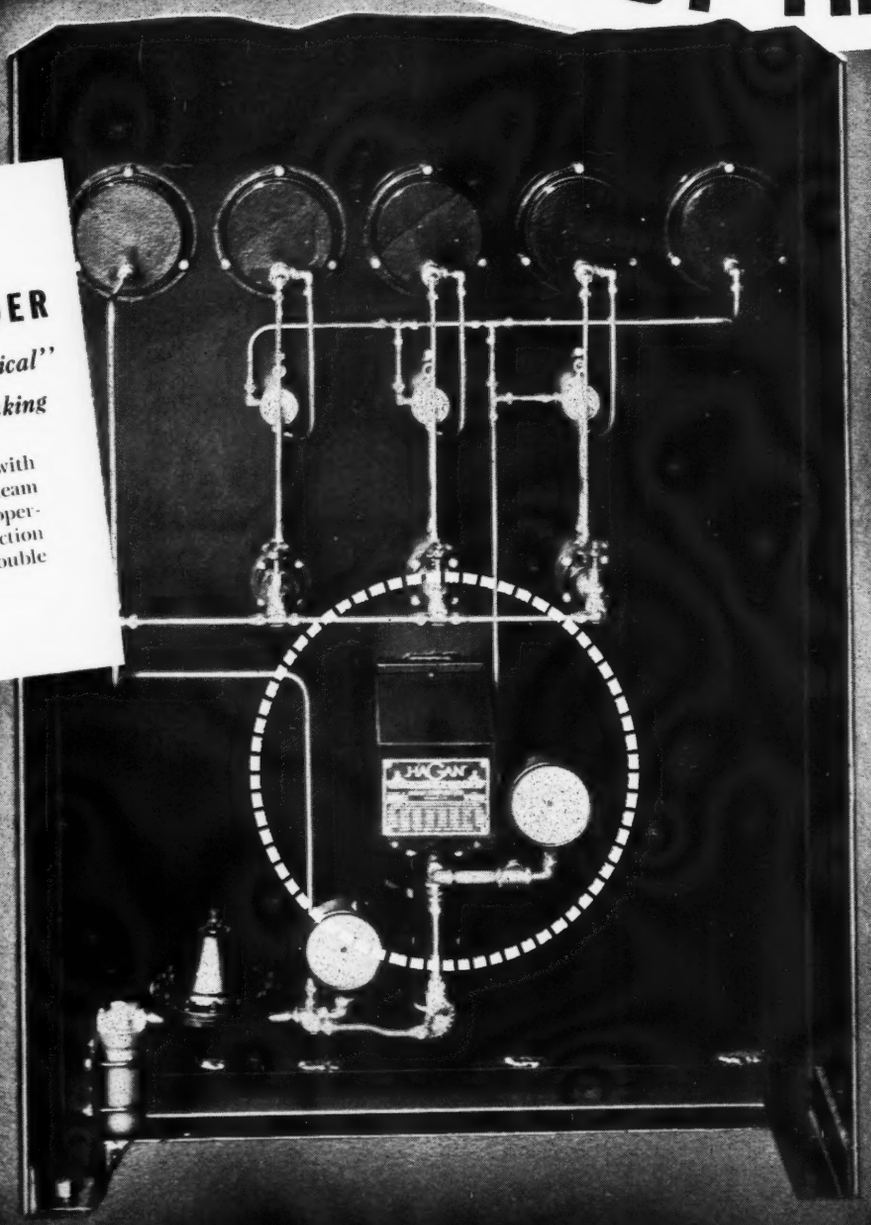
Write for Bulletin No. 917

SPECIALTY CORP. DETROIT MICHIGAN

DIAMOND SPECIALTY LTD. • WINDSOR, ONTARIO

Lights out!

...BUT THE



HAGAN
MASTER SENDER

...where the "mechanical" engineer does its thinking

Functions instantly with slightest changes in steam header pressure. Air operated, fast, positive action and freedom from trouble are assured.

BOILER PLANT CARRIES ON!

Combustion control so automatic that if you had to duck for shelter during a blackout you wouldn't have to give a thought to your steam situation

THAT kind of automatic combustion control is worth having. Certain Hagan-equipped plants in the war zone find it so now during air raids. It suggests a very interesting question.

Could you desert *your* plant hurriedly and feel completely confident that all would go well with your present system? You could if it had Hagan protection.

Hagan Automatic Combustion Control functions reliably, efficiently and *independently* under any load or operating conditions likely to arise.

And it does so instantaneously—at a speed no human hands could maintain.

If you have never enjoyed such freedom, that may look like a pretty big promise. But in thousands of Hagan-equipped plants nothing less is expected—or delivered.

Think what this would mean to you in meeting the trying conditions under which you work today.

And think of what you could also do for your steam output . . .

Hagan Control assures MAXIMUM steam output from any given fuel by introducing fuel and air to the furnace in correct proportions . . . MAXIMUM utilization value of the steam produced . . . MAXIMUM steam output from boilers of varying capacities through the proper distribution of *load* . . . MAXIMUM use of steam for productive work by reducing soot blowing operations.

Hagan Control is engineered, today, by the men who pioneered in the combustion control field. Hagan Control owes its leadership to proved mechanical superiority.

Why not let a Hagan combustion specialist explain how it works — show what it could do for your war effort? Write or wire, today.

HAGAN CORPORATION
HAGAN BUILDING
PITTSBURGH, PA.

SPECIFIC ADVANTAGES OF HAGAN AUTOMATIC COMBUSTION CONTROL

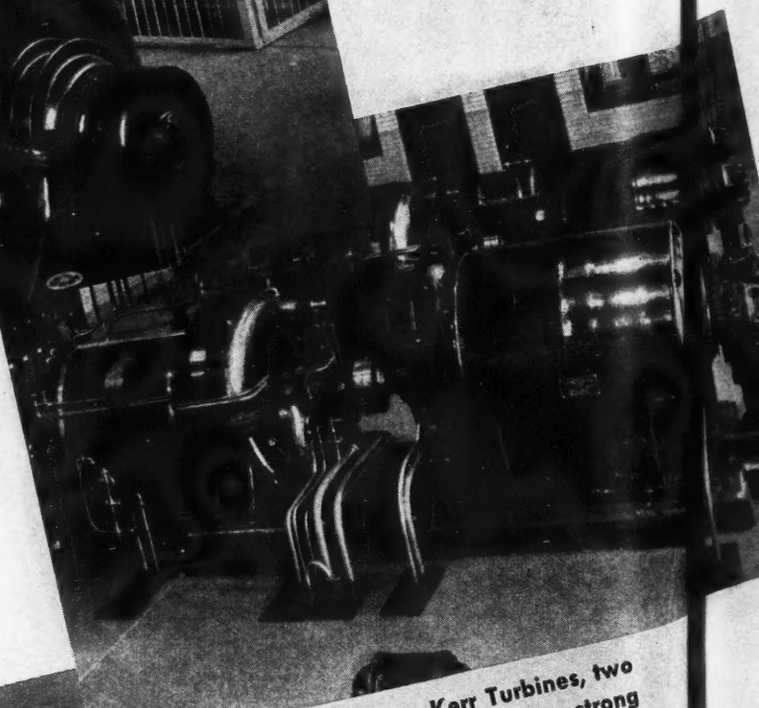
Simplicity of operation.
Ease of installation.
Ruggedness of equipment.
Sensitivity to small load changes.
Accuracy of adjustments for small variations.
Speed of movement, with stability, throughout operating range.
Flexibility in meeting individual plant conditions.
Engineered by the pioneers and leaders in automatic combustion control.

HAGAN *Automatic* COMBUSTION CONTROL

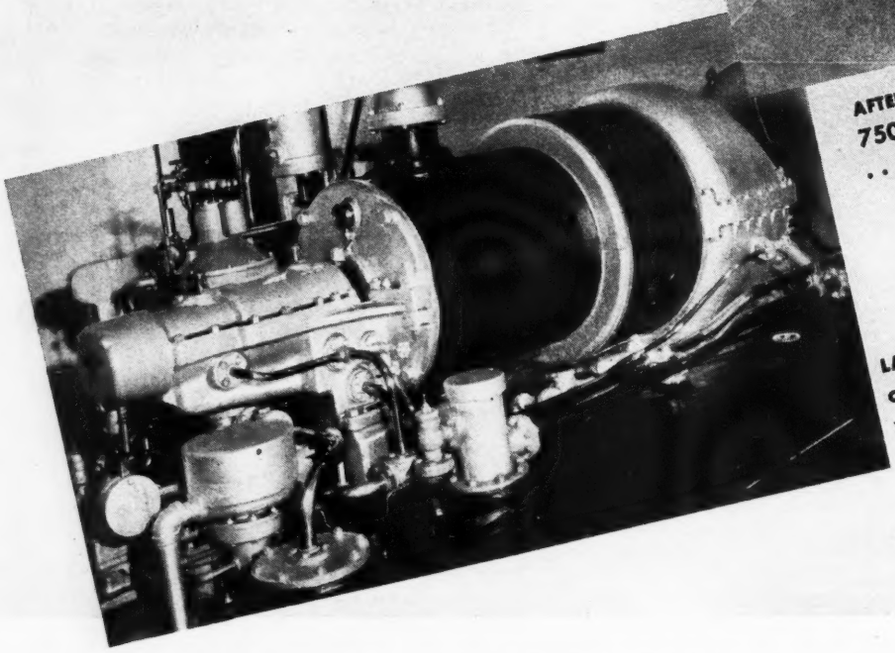
The pioneer . . . and still the leader

UNMARKING

80,000-kw. units in heart of war industry section. For 10 years, largely at full load, never an abnormal temperature rise in a bearing. On Regal Oil from the start.



AFTER 20 YEARS, three Kerr Turbines, two 750-kw. and one 295-kw., going strong . . . as always . . . on Texaco Regal Oil.



LARGEST CYPRESS SAW MILL IN THE WORLD, operates Allis Chalmers Turbine 12 years on Regal Oil with maximum efficiency.

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

TEXACO

TEXACO

SPEED . . .

REGARDLESS OF SIZE-TYPE-SERVICE

YOU CAN HAVE the positive assurance of sensitive turbine governor action and accurate speed control . . . when you use *Texaco Regal Oils.*

These Texaco Oils *resist* oxidation, *separate* rapidly from air and water. Free from gum and sludge forming elements, they keep lubricating systems clean, bearing temperatures normal.

From small standby turbines drafted for war service to the modern hydrogen-cooled giants, Regal Oils are helping to keep 'em on the line, delivering war-winning output.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent turbine operators everywhere. These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

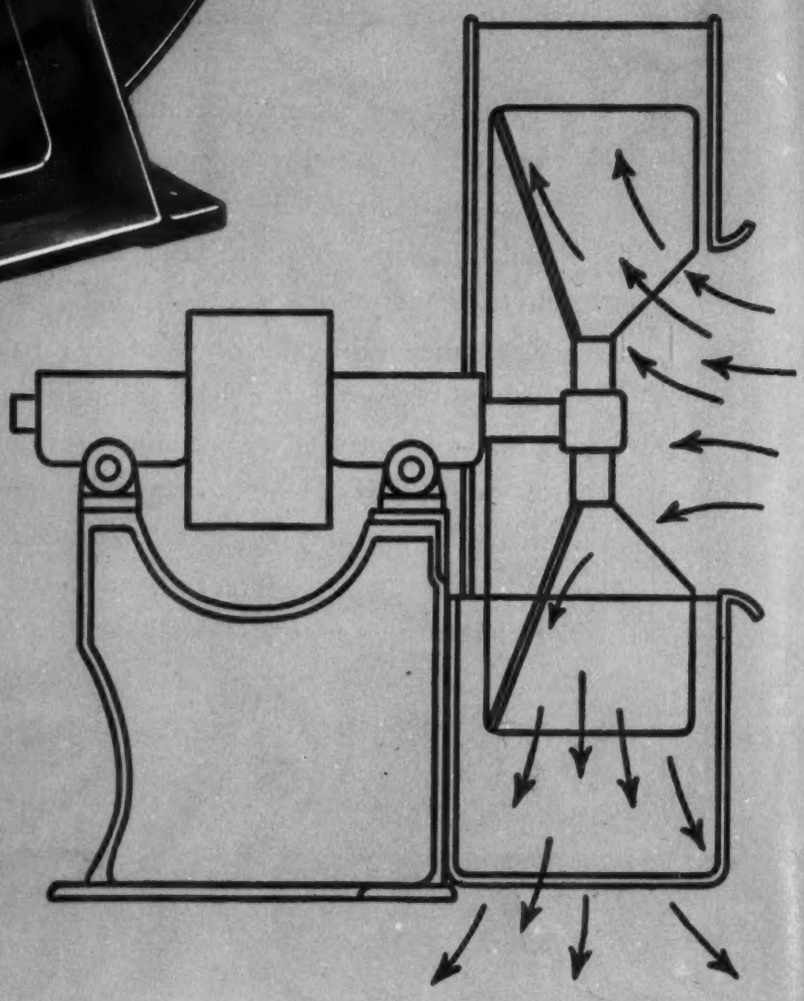
REGAL OILS

FOR ALL TURBINES

MAN OF

UNIQUE STURTEVANT STREAMLINE INLET AND ANGLE FLOW...

Diagram below illustrates the principle employed to reduce turbulence and step up efficiency in the Planovane Exhauster Design 3. Particle-laden air or gas enters from right. Because of the streamlined contour of the special inlet, the stream flow is instantly deflected away from center, hitting the back plate at an angle designed to *help* fan action rather than hinder it. By this means, too, backplate erosion is greatly reduced.



TYPICAL USERS

of Sturtevant Dust Control, Fume Exhaust and Pneumatic Conveying Equipment

General Electric Co.
Standard Oil Co.
Oliver United Filters
Washburn Wire Co.
Fafnir Bearing Co.
Western Electric Co.
Endicott Johnson Co.
Bethlehem Steel Co.
U. S. Gypsum Co.
American Coal Co.
Crown Cork & Seal Co.
Congoleum Nairn Inc.
Pepperell Mfg. Co.
Johnson & Johnson
Ford Motor Co.
Bakelite Corporation
United Aircraft Corp.
Frank H. Lee Co.
Scott Paper Co
Firestone Rubber & Latex Products Co.
Plymouth Motor Corp.
Liggett & Meyers Co.
Chase Brass & Copper Co.
Johns Manville Products Corp.
Ingersoll Rand Co.
Aluminum Company of America
John A. Roebling's Sons Co.
Timken Roller Bearing Co.
Monsanto Chemical Co.
Virginia Electric and Power Co.
U. S. Pipe & Foundry Co.
Central Maine Power Co.
Westinghouse Electric Mfg. Co.
Celanese Corp. of America
Yale & Towne Mfg. Co.
Baldwin Locomotive Co.
Keasby & Mattison Co.
S. S. White Dental Mfg. Co.
E. I. Dupont de Nemours Corp.
Revere Copper & Brass Co.
Allis Chalmers Mfg. Co.

STURTEVANT—FOUNDER OF

ALL WORK

All-Purpose Sturtevant Planovane Exhauster Design 3 meets widely varied needs of many industries

IN THE COLUMN at right are some of the hundreds of industrial exhaust jobs now being successfully handled by rugged Planovane Design 3 Exhausters. The diagram at left shows the main reason why Planovane Exhausters are preferred for industry's "dirty work" – Sturtevant Streamline Inlet and Controlled-Angle Flow. These unique features reduce slip-stream turbulence and cut down back-plate erosion. Result: higher over-all efficiency, lower maintenance costs, less time-out-of-service for repairs and replacements.

Two other reasons why the Sturtevant Planovane Exhauster Design 3 is a favorite all-purpose unit lie in its simple, sturdy construction and the wide range of sizes available. The *minimum* thickness of scroll, housing-side and blade sheets is 10 gauge! In the intermediate sizes, wheel blades are increased in thickness to 9 gauge, while above size 60 both scroll sheets and wheel blades are further increased to 7 gauge! Housing sides are increased to 7 gauge in sizes above 70. Eleven sizes, ranging from size 30 with 21-inch diameter wheel size to 100 with 72¼, enable the Planovane Design 3 to handle practically every kind of exhaust job.

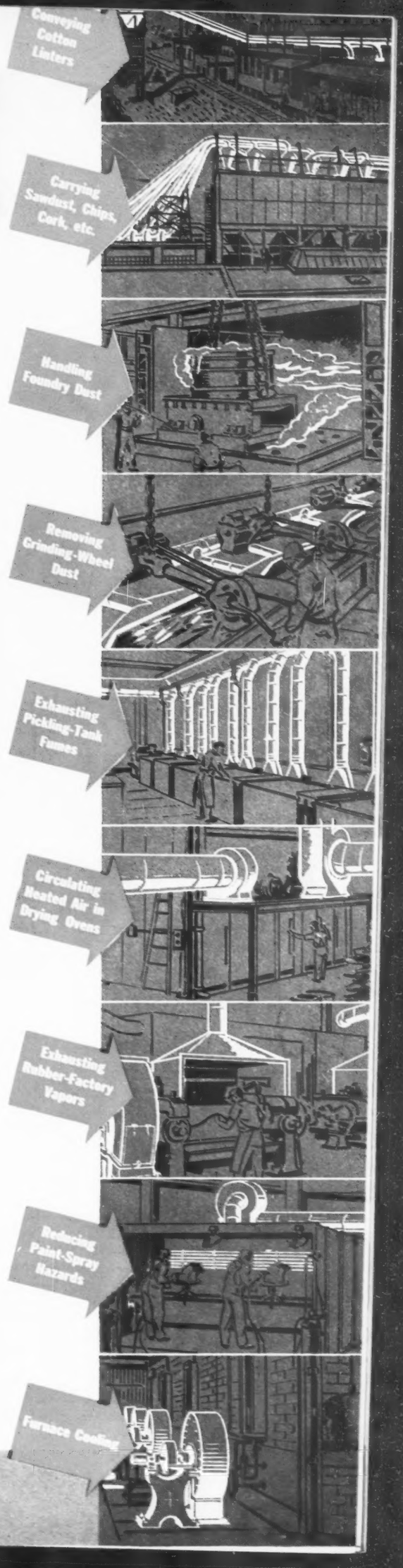
Your exhauster needs may not require an all-purpose unit such as the Planovane Design 3. Special conditions in your plant may call for a specific type of exhauster installation for which Design 3 might not be suitable. If so, Sturtevant can still help you, for all of the experience and knowledge gained by Sturtevant in founding and building the air-handling industry are here to help you solve your exhaust problems. For further information, write for Catalog No. 410-4.

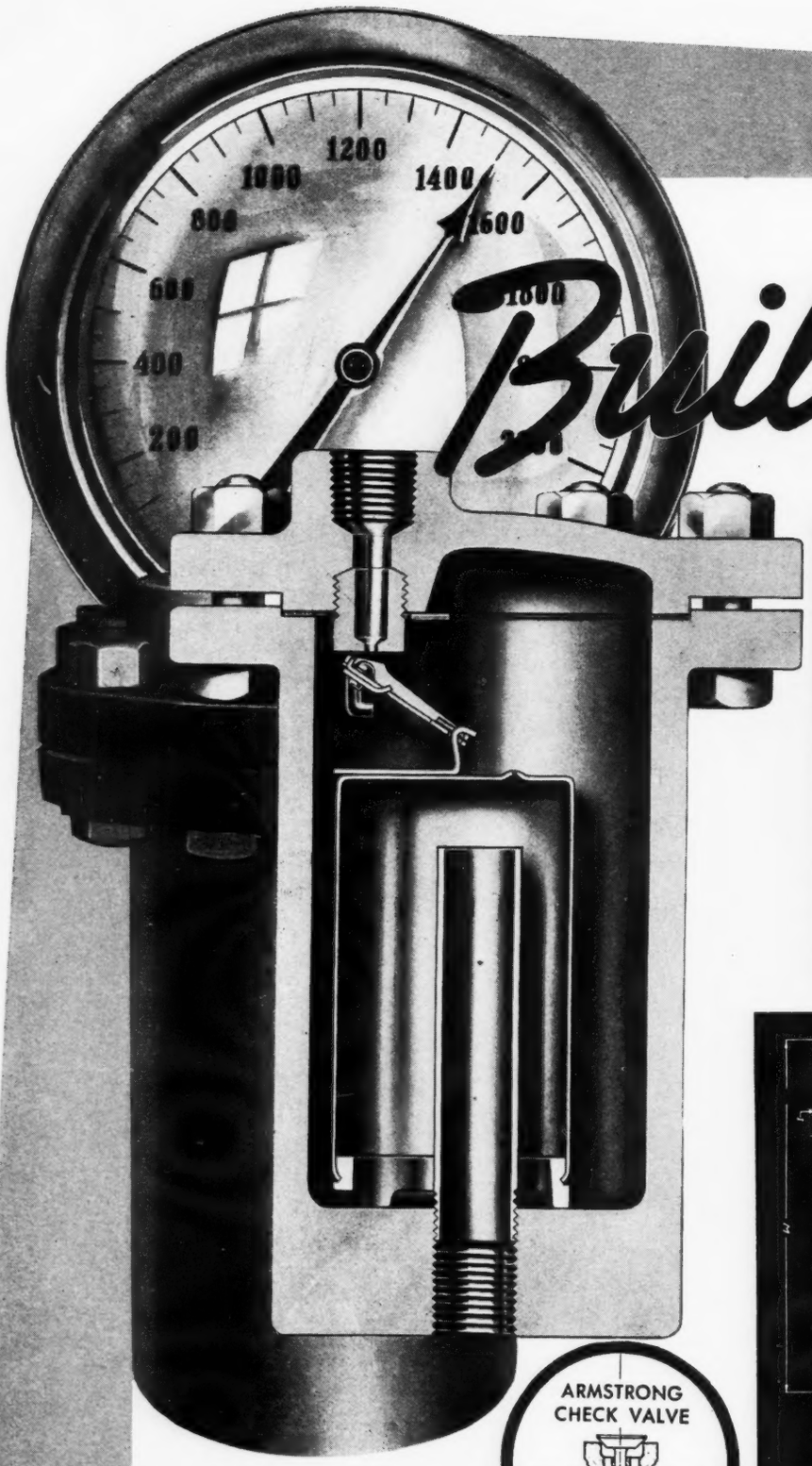
B. F. STURTEVANT CO., Hyde Park, BOSTON, MASS. • *Branch Offices in 40 Cities*
B. F. Sturtevant Company of Canada, Limited—Galt, Toronto, Montreal

Sturtevant
REG. U. S. PAT. OFF.

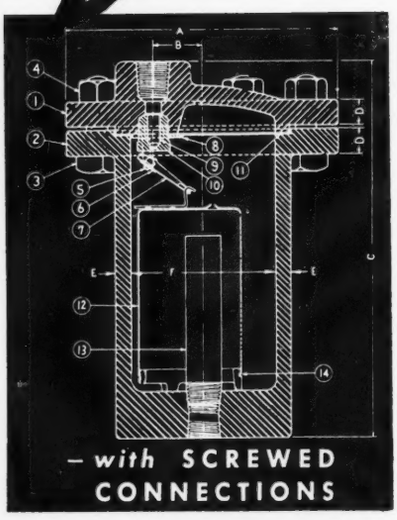
Puts Air to Work

THE AIR HANDLING INDUSTRY

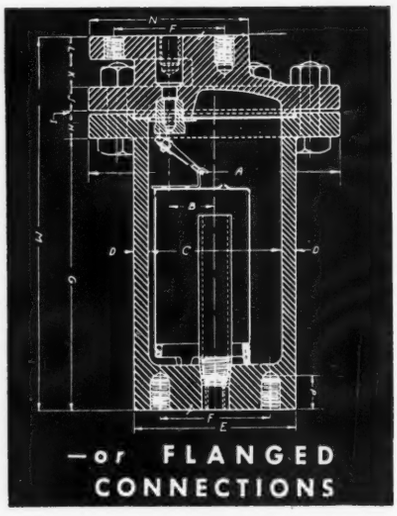




Built for



—with SCREWED CONNECTIONS



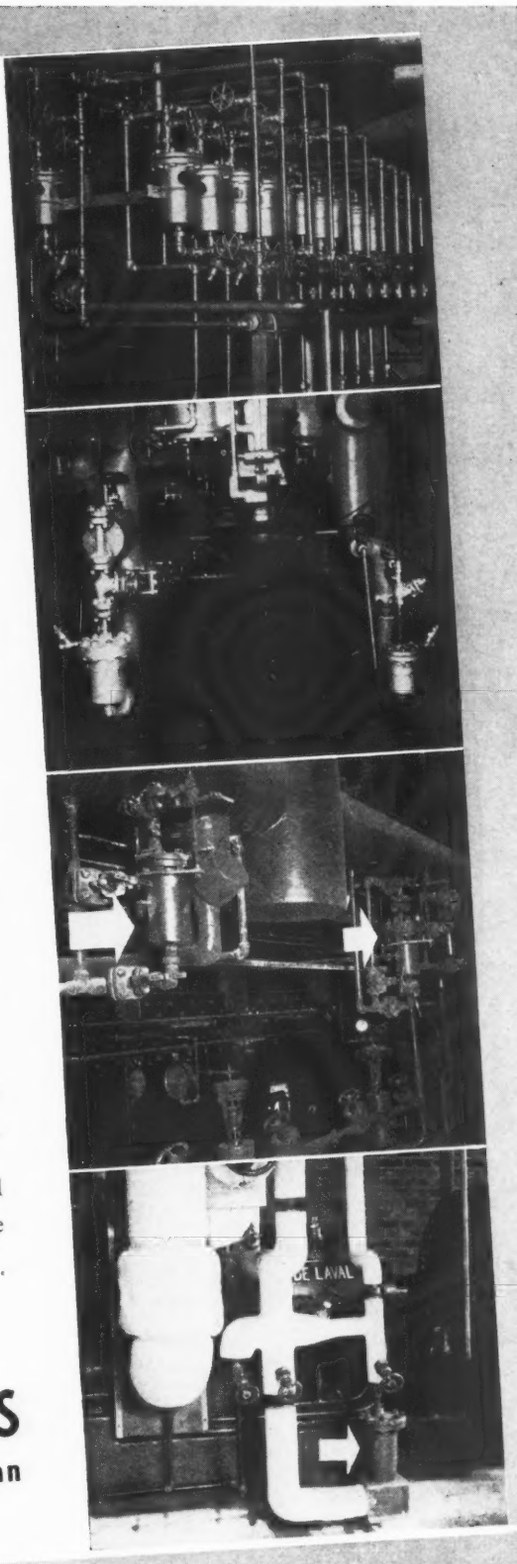
—or FLANGED CONNECTIONS

• Where check valves are required, specify ARMSTRONG INTERNAL TYPE CHECK VALVES — no external joints, quality construction, low cost!

ARMSTRONG INVERTED BUCKET STEAM TRAP

ARMSTRONG Forged Steel

HIGH TEMPERATURE HIGH PRESSURE SERVICE



ARMSTRONG pioneered the use of *special die forgings* for cap and body of high pressure steam traps, and Armstrong design has kept apace with the increased steam pressures used in modern central stations and industrial power plants.

ECONOMICAL TO USE! Wide choice of sizes starting with small ½ inch size. Built for either screwed or flanged connections.

FOR ANY PRESSURE! Built for 400, 600, 900, 1500 and 2400 lbs. steam pressure.

FOR ANY CAPACITY! Forged steel construction available for both plain traps and super-capacity compound traps.

UNSURPASSED QUALITY! Cap and body 79,000 lb. tensile strength, or higher. All-stainless steel trim. Heat treated valves.

COMPLETE ENGINEERING DATA. Printed information will be sent to you on request and without obligation. Complete capacity curves . . . trap specification and dimension sheets . . . installation diagrams.

ARMSTRONG MACHINE WORKS
812 Maple Street — Three Rivers, Michigan

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production

Iron Fireman P-S Stoker Cuts Fuel

Pneumatic Spreader

A Typical Example of Iron Fireman P.S. Performance

THE LIMOGES CHINA COMPANY
ESTABLISHED 1900
Manufacturing Potters
SEBRING, OHIO

May 13, 1942

Iron Fireman Corporation
3170 West 106 Street
Cleveland, Ohio

Gentlemen:

We think that possibly you will be interested in the results we have obtained with our Iron Fireman Pneumatic Spreader stoker, installed in the fall of 1940.

We have two 150 horsepower H.R.T. boilers, operating at 85 lbs. pressure. Before the installation of the Iron Fireman stoker it was necessary for us to fire both boilers by hand, in order to take care of our steam demands. The Iron Fireman was installed in one of these boilers and we were able to discontinue the use of the other, excepting in extremely cold weather, when it is used occasionally.

In addition to making cash savings on our fuel bills amounting to $2,448.00 per year, we have been able to maintain uniform steam pressure, under all operating conditions, and have materially cut the cost of boiler maintenance.

Another decided advantage is the fact that now we have a warm plant held at a uniform temperature, something we didn't have before installing the Iron Fireman.

We are more than satisfied with the performance of your equipment, which is reliable, well engineered and built, and is most satisfactory. We will be happy to show this equipment to anyone interested.

Very truly yours,

THE LIMOGES CHINA COMPANY

Harrison Keller

Vice President

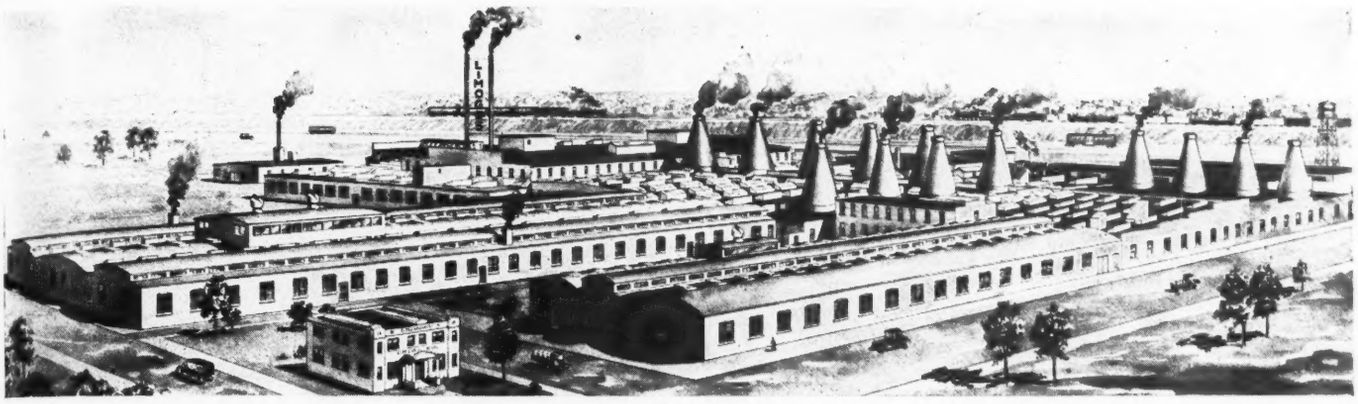
IRON FIREMAN

THE IRON FIREMAN

Automatic Coal Stokers

Costs $2448 Annually

Maintains Uniform Steam Pressure . . . Reduces Boiler Maintenance . . . Eliminates Use of One Boiler

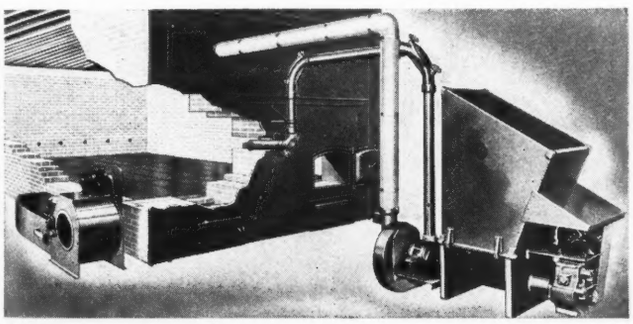


At the Limoges China Company, which was established in 1900 at Sebring, Ohio, an Iron Fireman P. S. stoker operates 24 hours a day supplying steam for power, processing, and heating.

Pneumatic Spreader Gives More FIRE POWER

In large plants from coast to coast Iron Fireman P. S. stokers give more *fire power*. One P. S.-fired 150 h.p. H.R.T. boiler at Limoges meets the steam demands formerly requiring two hand-fired boilers. Besides Iron Fireman P. S. firing reduced the fuel costs from $12,672 to $10,224 a year. P. S. firing maintains uniform steam pressure under all operating conditions.

Free Engineering Survey. Iron Fireman engineers are ready to make a complete survey of your boiler plant to see how an Iron Fireman stoker can give you more fire power. There is no obligation, and Iron Fireman engineers will be glad to collaborate with your plant or consulting engineer.



Quickly installed. This diagrammatic view shows the operation of the P. S. stoker. Steam-size coal is conveyed from the hopper or bunker to a transfer housing. Here the coal is picked up by a stream of air and carried to the furnace and grates. The fines burn in suspension, utilizing the conveying air for combustion.

Iron Fireman FIRE POWER Speeds War Production 8 Ways

1. Increases steam capacity from present boilers.

2. Greater capacity and firing efficiency for new boilers installed in new or enlarged plants.

3. Decreases man-hours of labor in boiler rooms, to release men for 7-day war production.

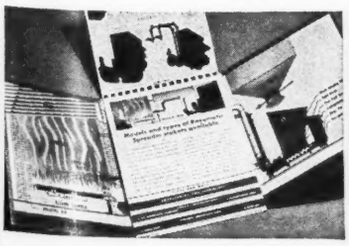
4. Freedom from dependence on fuel oil and gas, of which there are now serious shortages.

5. Makes more steam from a smaller tonnage of coal, thus conserving this vital fuel.

6. Burns local coals and lower grade coals which prevents transportation "bottlenecks."

7. Automatically controlled firing gives uniform steam pressure for power, heating and process steam, regardless of fluctuating loads.

8. Provides a *dependable* source of steam for all-out war effort.

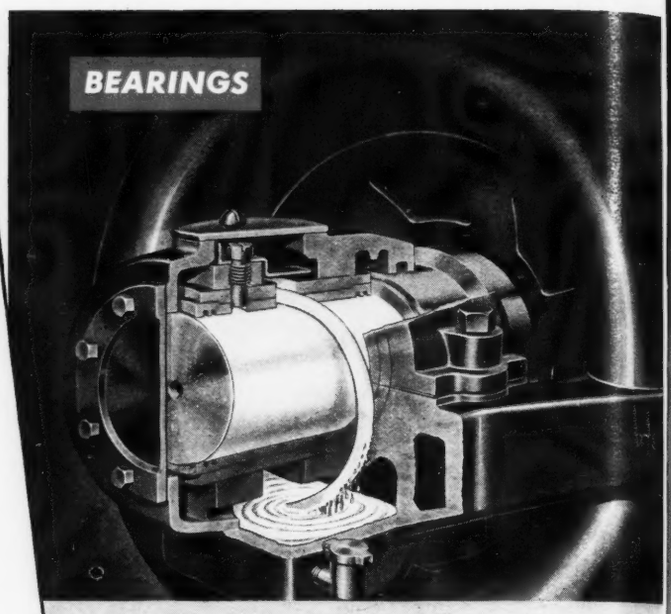


FREE BOOK on Pneumatic Spreader Firing

Contains full descriptions, capacities, operating data, etc., with layouts and photos of 10 actual installations. Sent free, on request. Write to Iron Fireman Mfg. Co., 3310 W. 106th Street, Cleveland, Ohio.

WHILE YOU'RE WORRYING ABOUT PRODUCTION...

YOU AND YOUR MEN are working hard for production... driving to meet shipping dates. You know your machines are being "driven"—often by "green" help. Wouldn't you welcome aid in making sure *every* machine is properly taken care of with Correct Lubrication?



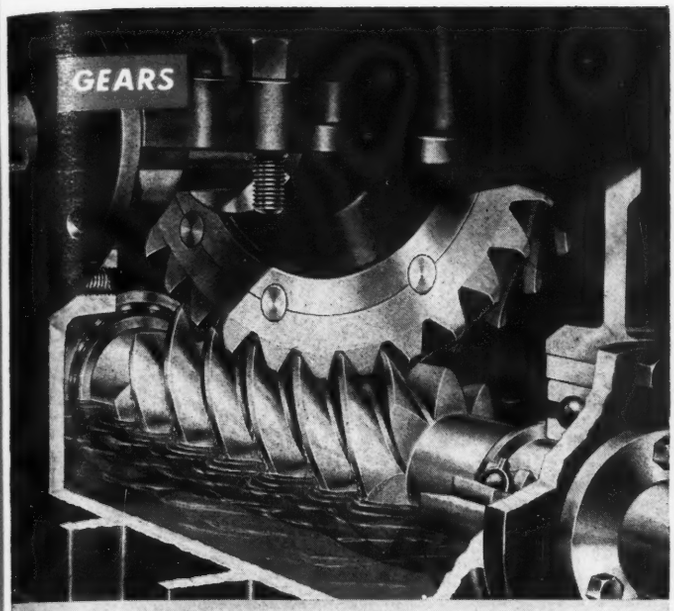
LOOKS SIMPLE—but size and type of bearing, speed, heat, load, method of application, all affect the choice of a lubricant. "Correct Lubrication" is a science! It demands skilled experience counsel.

Who's Looking Out f

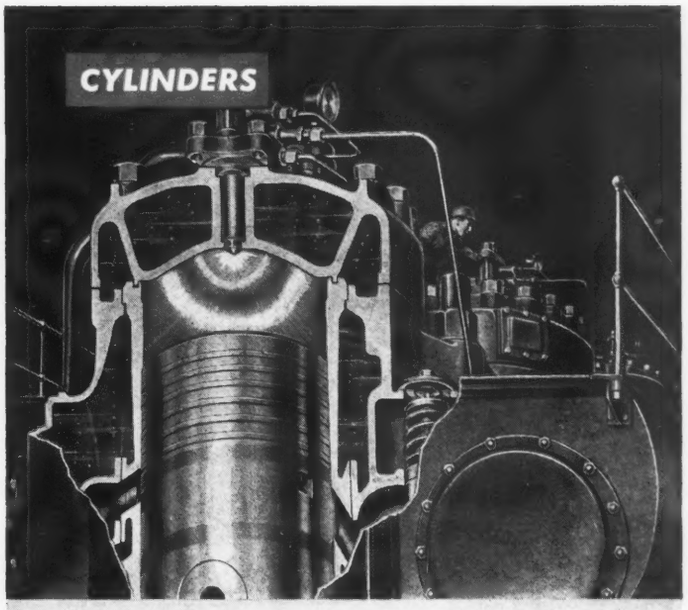
HERE'S A PLAN TAILOR-MADE FOR YOUR PLANT

THOSE TWO STEPS at the right bring you the sum of Socony-Vacuum's 76 years' experience, *the world's greatest*, in the lubrication field. Today, when there is no time for "second guesses" this knowledge is proving its value in helping industry do its biggest job!

1 LUBRICATION PLANNING—After careful study of your machines and their operating conditions, your Socony-Vacuum man will work out a guide of lubrication recommendations with your own engineers.



IRREPLACEABLE—Precision-made gears, in fact all production equipment, should be viewed as irreplaceable. This places an added burden on lubrication . . . emphasizes need for only the best!



DEPENDABLE POWER—The hum of your power plant is the heartbeat of your production line. Diesels, turbines, steam engines exist on "Correct Lubrication" as prescribed by a lubrication engineer.

for Your Machines?

2 LUBRICATION CONTROL—By means of this lubrication program . . . through the help of the Socony-Vacuum man . . . you will be freer to drive for more production. He will gladly help look out for your machines!

TO HELP MAINTAIN WARTIME PRODUCTION CALL IN

SOCONY-VACUUM

FOR *Correct Lubrication*

GARGOYLE Lubricants

SOCONY-VACUUM OIL CO., INC. • Standard Oil of N.Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

NOW 2300-VOLT MOTOR CONTROL IS NO LONGER A PROBLEM

Here's everything you need between feeder and motor in a single control unit

Pre-engineered for Your Job

Now, you can order a 2300-volt control unit as easily as you order a simple magnetic switch. Just tell us a few simple facts: the complete rating of your motor, its locked-rotor current, and the type of load it drives. We will deliver a factory-assembled control unit that meets every requirement of your job. These 2300-volt starters come to you as one complete unit with built-in short-circuit, overload, and undervoltage protection.

No Special Enclosures to Build

You don't have to build any costly, time-taking, protective enclosures for these starters. The starter and bus structure are enclosed in a sturdy, steel, dead-front cabinet in which the high-voltage compartments have been segregated to completely protect your personnel and equipment.

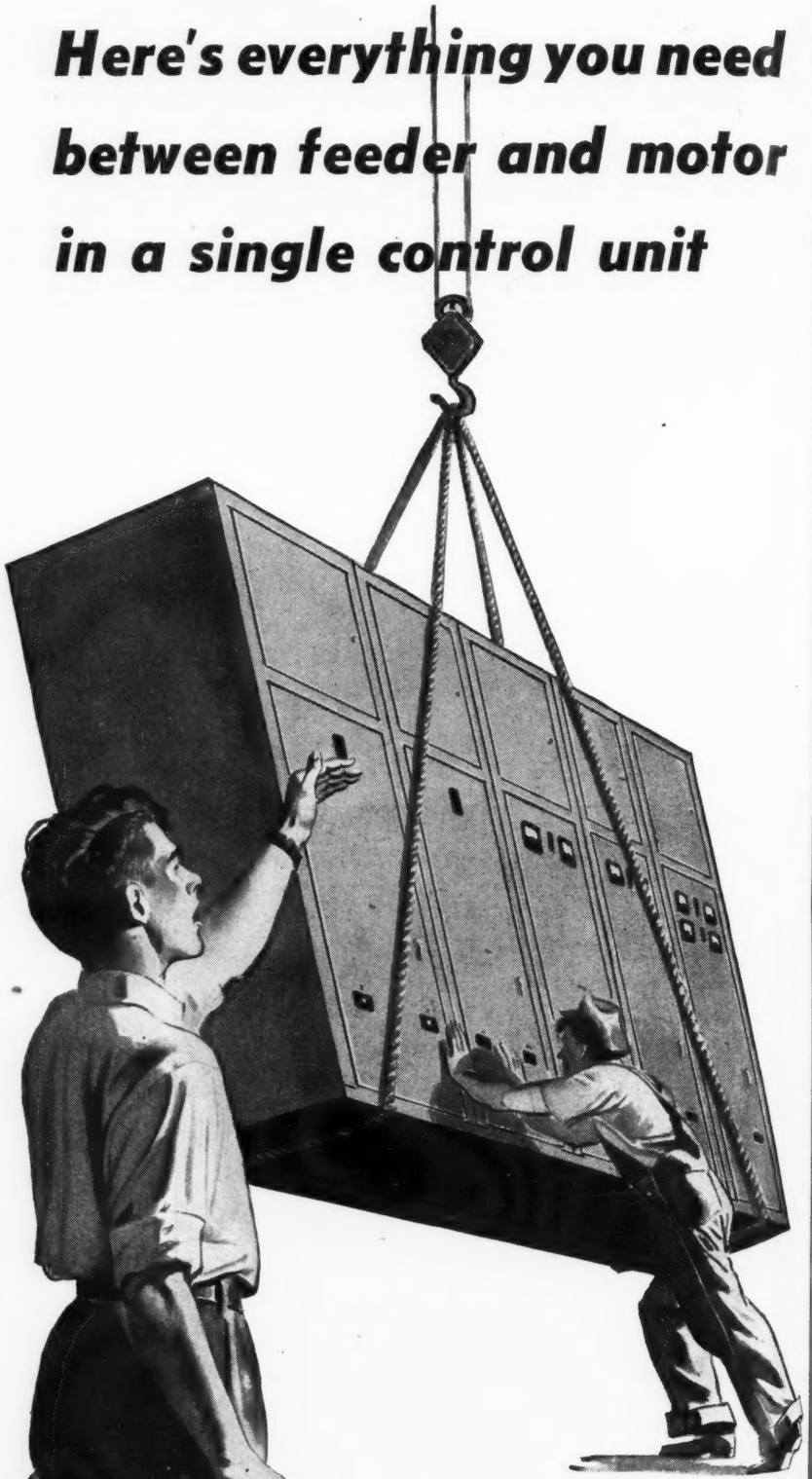
For a Wide Variety of Motors

These starters are available for full-voltage or reduced-voltage starting, reversing, and braking of squirrel-cage, two-speed squirrel-cage, wound-rotor, and synchronous motors. You can get one unit to control one motor or have several combined in one board to control any combination of these motors.

Bulletin GEA-3660 gives a well-illustrated description of all the features that make this new starter tops in the 2300-volt field. Send for it today. *General Electric, Schenectady, N. Y.*

Neat in appearance, compact, and easily accessible.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment



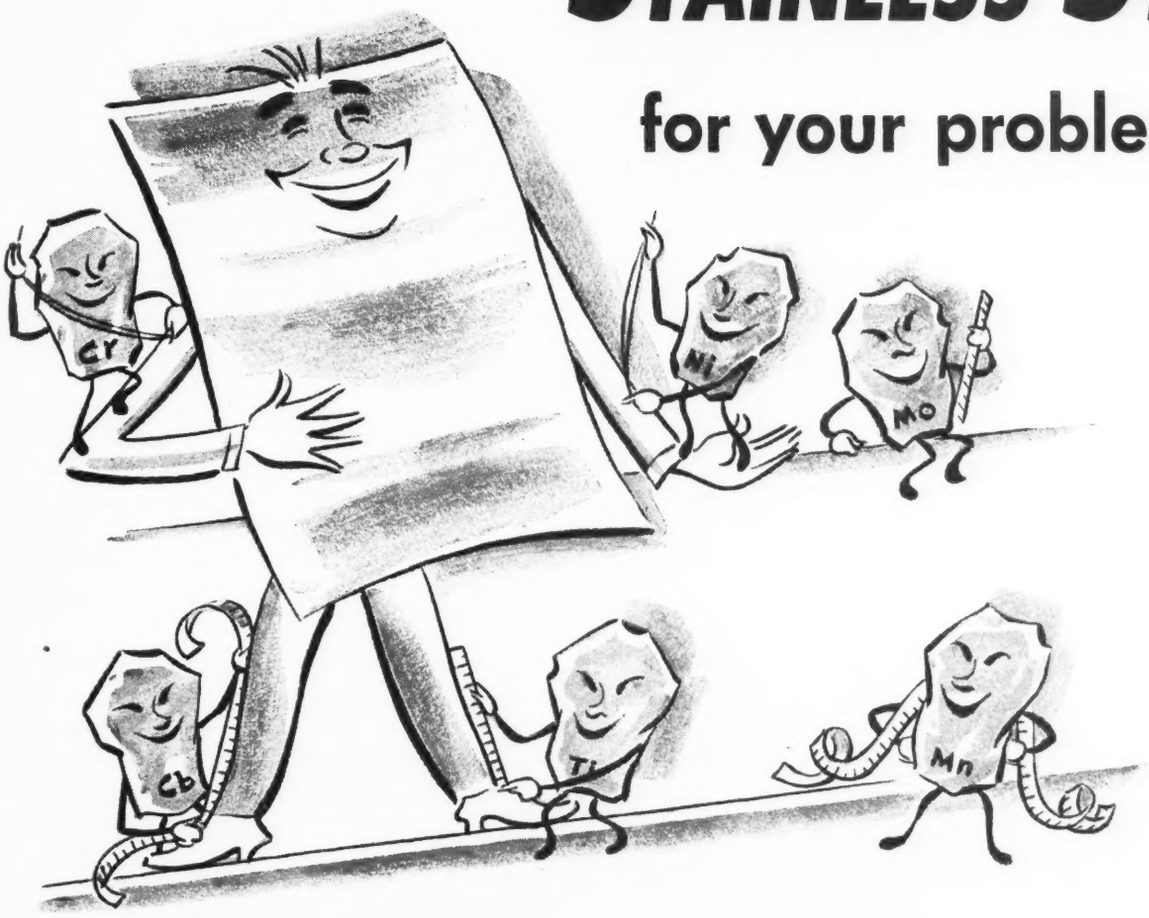
ONE UNIT OR A DOZEN

These starters can be shipped separately or built as a unit control board consisting of several starters.

GENERAL ELECTRIC

662-7-3490

Are you using the best STAINLESS STEEL for your problem?



Chromium and Nickel, as well as such modifying elements as Manganese, Molybdenum, Columbium, and Titanium . . . all critical materials . . . are used in the production of different kinds of stainless steel. Each contributes particular properties to the steel . . .

Chromium makes stainless steel "stainless" for it gives steel resistance to corrosion and oxidation, as well as to heat and abrasion.

When present in large enough quantities, Nickel changes the structure of chromium steels and improves their fabricating properties. It also increases the resistance of stainless steels to corrosion and heat.

Manganese acts like Nickel. Furthermore it improves the hot ductility of the steel, and increases its resistance to corrosion and impact.

Molybdenum increases the resistance to pit-type corrosion.

Columbium and Titanium make stainless steel insensitive to a type of corrosion resulting from exposure to high temperatures such as in welding.

Electro Metallurgical Company engineers have more than 35 years' practical experience in the selection and use of stainless and other alloy steels. They can give helpful advice on the best analyses of steel for your particular problem.

Using the steel best suited to your problem will save you time and money and will help conserve vital materials. When you have a specific problem in the selection or use of stainless and other alloy steels, consult us. There is no obligation.

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York, N. Y.

In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

Electromet

Trade Mark

Ferro-Alloys & Metals

FACTS *you should know about* HARD-FACING MATERIALS

By means of hard-facing—which is the process of welding on to wearing parts a coating, edge, or point of a hard metal—it is possible to protect metal surfaces that normally wear away rapidly in service. This method not only makes industrial parts last from two to twenty-five times longer, but also reduces time lost for replacements, lowers power consumption, and helps to maintain high efficiency. In addition, hard-facing often makes possible the use of substitute base metals in the fabrication of parts. Outlined below are facts you should know when selecting hard-facing rods.

Properties Required for Hard-Facing

High-quality materials are required to obtain full benefit from hard-facing. The materials should possess the following properties:

1. Inherent hardness.
2. Resistance to abrasion.
3. "Red Hardness"—or the retention of initial hardness up to red heat.
4. Ease of application by ordinary welding techniques.
5. Resistance to high-temperature oxidation during application by welding.
6. A melting point slightly lower than that of steel, the usual base metal.
7. A coefficient of expansion close to that of the base metal.

Types of Materials Available

Group 1—These alloys are relatively low in cost. They are alloy steels consisting of an iron base with less than approximately 20 per cent of alloying constituents. *Example: Hascrome iron-base hard-facing rod.*

Group 2—These are iron-base alloys containing more than 20 per cent of alloying elements. They are useful for services involving more severe abrasive wear than the metals of group 1. *Example: Haynes Stellite "93" hard-facing rod.*

Group 3—This group is made up essentially of non-ferrous cobalt-chromium-tungsten alloys. Hardness is inherent and retained at high temperatures. *Example: Haynes Stellite grades 1, 6, and 12 non-ferrous hard-facing rod.*

Group 4—The fourth group consists of tungsten carbide "diamond substitute" materials, supplied in a variety of forms, and combining a maximum of wear resistance with cutting qualities when applied on the cutting edges of drilling tools. *Example: Haystellite composite rod, tube rod, and inserts.*

Send for Helpful Literature

Write for the booklet "*Hard-Facing Materials Data.*" It can be tacked on the shop wall for convenient reference on such points as the selection of the right rod, application techniques, and amount of rod required. A copy will be sent without charge.

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

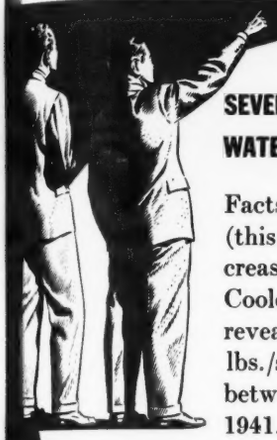
New York, N. Y. UCC Kokomo, Ind.

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

HARD-FACING RODS FOR EVERY PURPOSE

The words "Haynes Stellite," "Hascrome," and "Haystellite," are registered trade-marks of Haynes Stellite Company.

WILL WATER-COOLED STOKERS PROVE BEST IN YOUR CASE, TOO?



SEVERE TEST IN OHIO PROVES WATER-COOLED STOKER RELIABILITY

Facts just disclosed by another plant (this one in Ohio) verify claims of increased reliability for Taylor Water-Cooled Stokers. The figures of this plant reveal an average burning rate of 51.2 lbs./sq. ft. during a run of 3,572 hours between May 20, 1941 and October 23, 1941. In the same period a high of 64 lbs./sq. ft. for a 24 hour run and 62.7 lbs./sq. ft. for 72 hours were attained. The severity of this trial is evidenced by the ash softening temperature (2100°F.) and the use of 350° preheated air.

Read These Excerpts of Letter from a User to an Inquirer

Gentlemen:

Our Taylor Water-Cooled Stoker is a part of a steam generating unit which has a maximum continuous rating of 150,000 pounds per hour.

The normal daily variation in load is from 70,000 to 120,000 pounds per hour. The extreme variation has been from a minimum of 25,000 to 170,000 pounds per hour.

Initial operation of this unit began in September, 1939 and the unit has been in service ninety-four per cent of the time since the aforesaid date.

We have not yet replaced any stoker tuyeres and our total charges for labor and material on stoker maintenance is practically negligible, in fact, it amounts to about seven-tenths of one cent per ton of coal.

The fuel burned on this stoker is an Ohio coal with an ash fusion temperature of 2,150 to 2,350 degrees Fahrenheit.

In general, our experience to date has been that the water-cooled stoker has more dependability for long continuous service and also has the ability to burn a greater variety of coals with a special reference to utilization of those coals which have lower ash fusion temperatures.

Advantages of Water-Cooled Grates on Mid-Western Coals:

Some of the observed advantages of water-cooled stoker installations burning mid-western coal are:

1. More uniform flow of coal, with consequent ease of distribution.
2. A more homogeneous fuel bed. Result: Better air distribution.
3. Low maintenance, supported by performance records.
4. Lower power consumption as a result of minimum clinker formation.
5. The range of fuels with low fusion ash characteristic is greater.
6. Test efficiencies are more closely approximated in regular plant operation, because of the ease of maintaining the most advantageous fuel bed contour.
7. Availability of the unit materially increased.
8. Quick chilling of molten ash particles assures a continuous and even flow of fuel.
9. Water-cooling provides an additional safety factor against possible errors in operation.

File this curve in your memory!

Because it shows the trend, we again reprint this curve of Taylor Water-Cooled Stoker sales. Refer to this curve when you want to know the trend in which power plant engineers are thinking—today as well as for tomorrow.

3-Way Improved

Although there are many ways in which Taylor Water-Cooled Stokers improve operation, these three are most important: **1. Increased reliability. 2. Increased fuel flexibility. 3. Higher operating efficiency.** Catalog W, offered in the coupon at the lower right, shows advantages, construction, and installations of Taylor Water-Cooled Stokers. Have you read it? Hundreds have. Send for it.

A-E-CO TAYLOR WATER-COOLED STOKER

A-E-CO TAYLOR STOKER
Water Cooled

AMERICAN ENGINEERING COMPANY
2400 Aramingo Avenue, Phila., Pa.

Send me without obligation a copy of the 8-page Catalog W describing Taylor Water-Cooled Stokers.

*Name*_____

*Company Name*_____

*Address*_____

*City*_____ *State*_____

Here's Your Wartime "Know-How" Data on Steam Traps

These are difficult times for the power engineer. He is called upon for greater production—asked to make radical changes and to specify equipment for new installations. There is little or no time to shop or to guess. He must either know or have immediately available data on all types of power equipment. When it comes to installing steam traps, his best source of information is the book "How To Choose a Steam Trap." This book gives instant data for all types of steam trap installations. It shows how to work out steam trap installation problems correctly. It gives complete tables on specifications, capacities, and pressures for traps for all purposes. It tells you why the Super-Silvertop Steam Trap with its simplified piping, guided bucket, smooth large passages, is the most dependable trap for wartime installations. Better send for your complimentary copy of this book now and have it at hand.

THE V. D. ANDERSON COMPANY
1934 West 96th Street • Cleveland, Ohio

Super-Silvertop
STEAM TRAPS

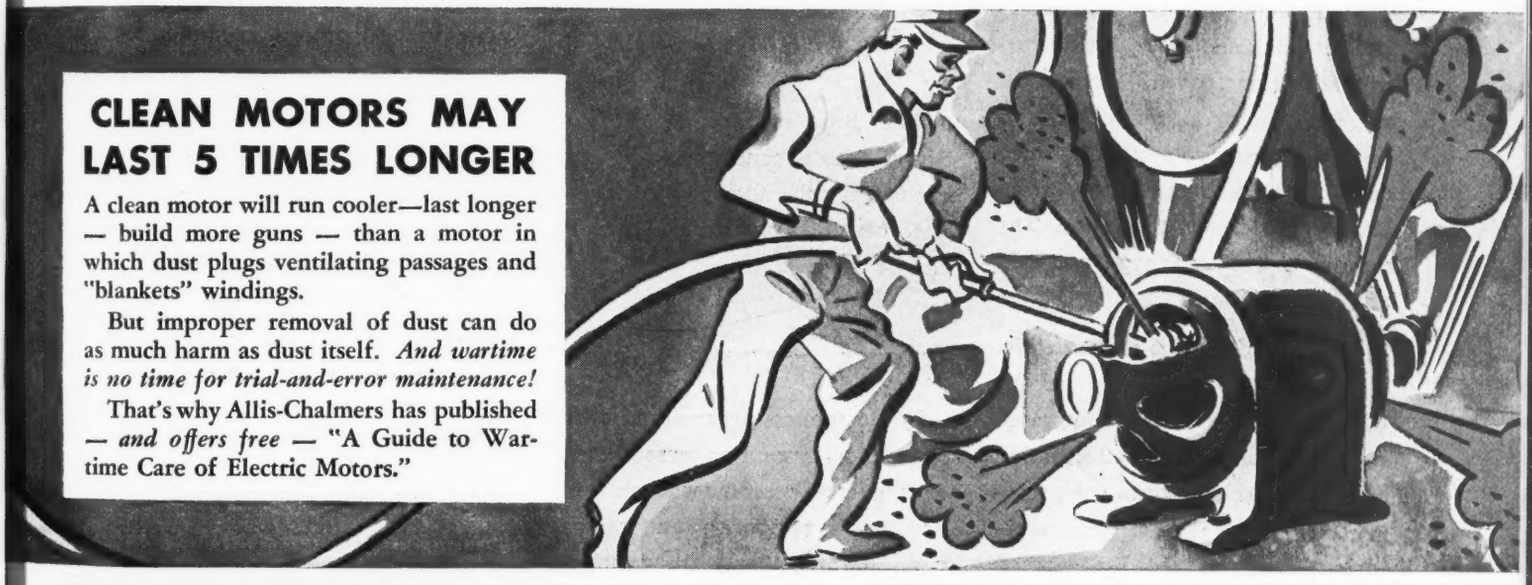
War Against Wear

DUST "BLANKET" NOW MORE DANGEROUS

The more dust that accumulates in the wound section to "blanket" a motor, the more danger of destructive temperatures. *And today's round-the-clock operation gives a motor little chance to cool off!*

In a production war like this one, everything that harms our motors helps the Axis. Dust, moisture, stray oil, friction — *every* motor enemy must be fought with skill and energy!

IS PART OF THE WAR
Against the Axis

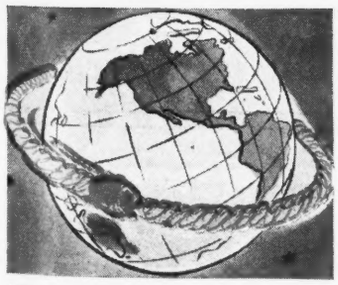


CLEAN MOTORS MAY LAST 5 TIMES LONGER

A clean motor will run cooler—last longer — build more guns — than a motor in which dust plugs ventilating passages and "blankets" windings.

But improper removal of dust can do as much harm as dust itself. *And wartime is no time for trial-and-error maintenance!*

That's why Allis-Chalmers has published — *and offers free* — "A Guide to Wartime Care of Electric Motors."

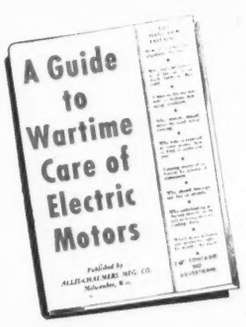


AROUND WORLD IN 8 DAYS — rotor travel in many motors working 24 hours a day for Victory!

Send for this Valuable new Book. It's Free! ⟶

Everyone taking a fresh, new look at his maintenance operation will find "A Guide to Wartime Care of Electric Motors" immensely helpful.

It's completely illustrated, clear, highly interesting—applies to *all* makes of standard, general-purpose motors. Contains no advertising. Belongs in every engineer's and executive's technical library.



ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Yes, I would like to receive *free of charge* your new motor care book.

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(Title) _____

(Company) _____

(Street Address) _____

(City and State) _____ A 1536-5

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE

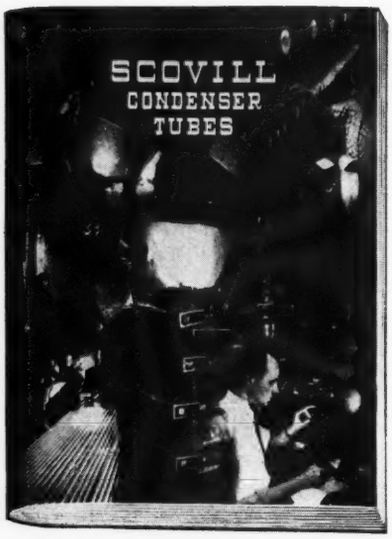
Suggestions for Prolonging Condenser Tube Service Life

Now, more than ever, condenser tube dependability and long life are factors of importance, both from the angle of uninterrupted service and the conservation of copper alloys.

In these respects, Scovill facilities will prove to be valuable to you, for Scovill offers one product—and three services.

The first service is *men*—Scovill engineers who can help you get the most out of your present tubes—then can suggest the most economical retubing alloy for your operating conditions. With a practical understanding of condenser and heat exchanger problems, these men can be of help to you on any problem pertaining to tube use. The service is free—we hope you will use it.

The second service is *manuals*. Have us send you a copy of the Condenser Tube Booklet illustrated—a source of valuable information on prolonging condenser tube service life. Write Scovill Manufacturing Company, 13 Mill Street, Waterbury, Connecticut.



The third service is *metals*. Scovill has a condenser and heat exchanger tube alloy to meet every need where a nonferrous alloy tube can be used:

MUNTZ METAL

For steam condensers and other low-temperature, low-pressure heat exchangers where raw water is fresh and low in temporary and permanent hardness and in dissolved gases (CO_2 and O_2), as, for example, many locations on the Great Lakes and a few inland rivers.

COPPER

For steam condensers where fresh water is used, and particularly with relatively soft waters carrying high concentration of dissolved gases (CO_2 and O_2); where the conditions of operation are such as to cause "dezincification" in the brasses. Copper tubes are also frequently used in heat exchangers not requiring great physical strength and where sulphur compounds and oxidizing acids are absent. Pure copper softens at approximately 200° C.

Considering the importance of economizing the use of copper for the war program, we suggest your consideration of "Phosphorized Admiralty Tubes" (with their lower copper content) for installations where copper would normally be used.

ARSENICAL COPPER

The addition of the 0.15% to 0.75% Arsenic to pure copper raises

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL

one product . . .
SERVICE IN MANUALS . . .

its softening temperature so that it can be used in heat exchangers operating at temperatures up to 300° C. Hard drawn Arsenical Copper tubes have approximately the same strength as "finish annealed" Admiralty or Muntz tubes. They are usually supplied in the hard condition with ends annealed if necessary. Both laboratory tests and field service of this material indicate an improvement in corrosion resistance over previously used type of copper.

"Phosphorized Admiralty Tubes" will perform satisfactorily in most installations where Arsenical Copper is usually used. This substitution is particularly desirable now as "Phosphorized Admiralty" requires 30% less copper.

RED BRASS

For condensers and heat exchangers where it is necessary to combat "dezincification" and where acidity, if any, is of a low order. Red Brass is stronger and stiffer than copper and has excellent resistance to "dezincification" in fresh waters high in temporary and permanent hardness and in soft waters carrying high concentrations of dissolved gases (CO_2 and O_2).

"Phosphorized Admiralty Tubes" will also be a satisfactory material for these conditions. In the present tight copper situation, we suggest your use of "Phosphorized Admiralty" with its lower copper content.

ADMIRALTY

Regular

For condensers and other heat exchangers where raw water, whether fresh, brackish or saline, pure or polluted, ranges from moderately acid to alkaline. Regular Admiralty has excellent strength and ductility at temperatures up to 200° C. (390° F.) where a slight drop occurs.

"Phosphorized"*

Wherever dezincification of Regular Admiralty Tubes has been a corrosion problem, the use of Phosphorized Admiralty is suggested. This alloy combines the general excellent corrosion-resistant properties of Regular Admiralty, a desirable fine grain structure, and very marked resistance to dezincification. Several million pounds of Phosphorized Admiralty Tubes are now in service and reports of their ability to withstand both general corrosion and dezincification have been very favorable. (Priced the same as Regular Admiralty.)

ALUMINUM BRASS

In many installations where tube deterioration results from impingement (erosion-corrosion) attack, this alloy has proved superior to Admiralty. The alloy can be used with salt, brackish or fresh water at normal temperatures. The desirable corrosion-resistance properties probably result from the formation of a tough, thin, continuous film of aluminum oxide which forms on the exposed surface.

Principal uses to date and best performances have been in the marine field and tidewater plants where saline waters are encountered.

CUPRO NICKEL 70-30

Recommended for the most severe conditions in which copper alloys are serviceable. The protective film formation on this alloy is impervious, tough, and continuous. It protects against the chemical or electro-chemical action of the commonly encountered circulating media in power, petroleum, and other process plants. Erosion-corrosion resistance is of a high order.

*"Phosphorized Admiralty Tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by Scovill Manufacturing Company, the owner of this patent.

Limitation Order L-154 issued by the O.P.M. This order limits the use of non-ferrous condenser tubes in land power stations to Muntz metal for fresh water plants and Admiralty metal for salt water plants. No non-ferrous metals containing more copper and more tin than these two are permitted by the order.

Condenser Tubes

. . . three services

SERVICE IN METALS . . . SERVICE IN MEN

HEAD IT FOR THE LAST . . . "Round-up"

AMERICA is engaged in the biggest round-up of all history -- a round-up of junk for conversion to war materials.

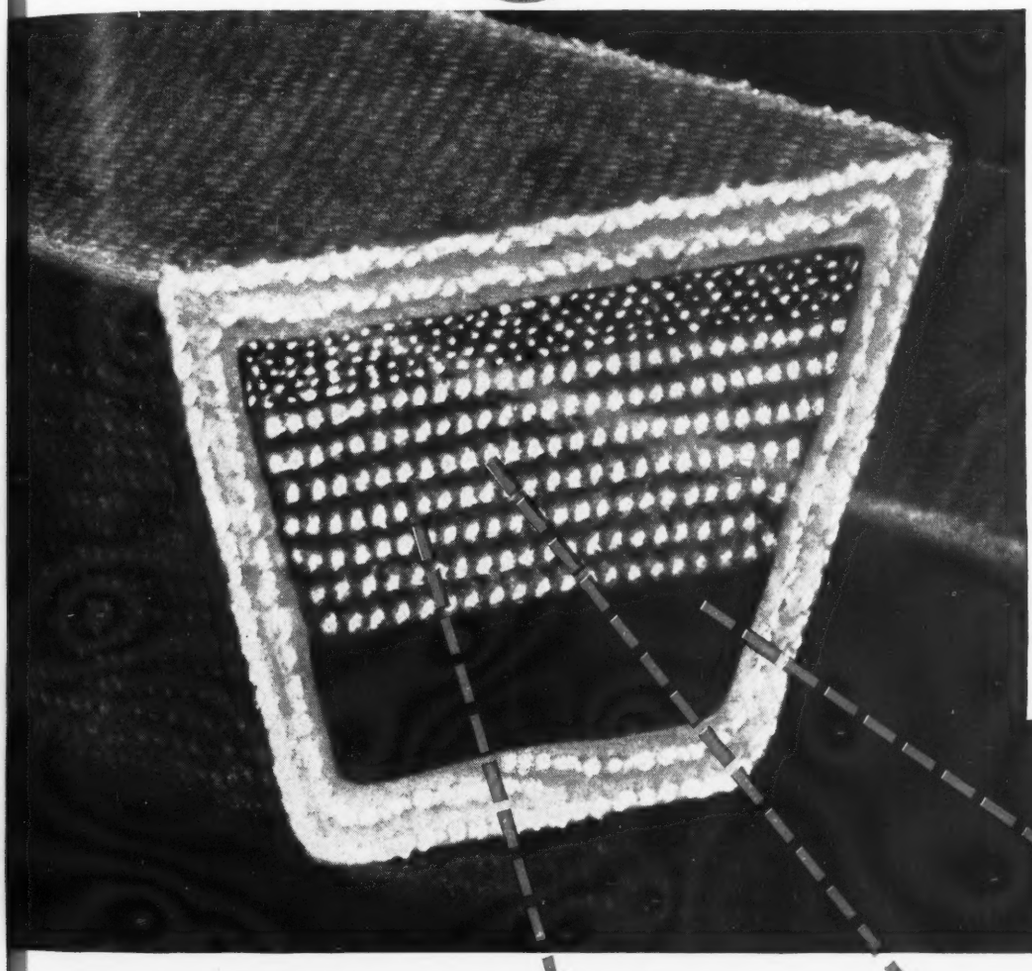
Yet millions of tons of idle metal are still in hiding, in spite of this nation-wide campaign. Some of it may be in your home, or factory, or warehouse Worn-out machinery, pipe, wire, sheet metal, odds and ends -- all, converted to scrap, will go to produce more than double their own weight in prime fighting steel.

To collect the 6,000,000 EXTRA tons of scrap steel that our war needs dictate, means that YOU and every other citizen must contribute every pound of useless metal you can corral.

Don't fail Uncle Sam in this drive. Get out YOUR scrap. Start it on its way. Head it for its last round-up.

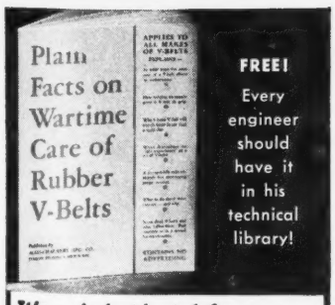
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO

X-Ray of IDEAS FOR Longer Wear



Here's the Inside of a Texrope Super-7... America's newest and most Advanced V-belt. Note the new Ways longer Life is Built right into it... for they Point to Ways *you* can Add to the Life and wartime Efficiency of your V-belts... whatever "Make" you may Use!

V-Day needs every V-Belt



It's packed with vital facts on care of *all* makes of V-belts — contains no advertising. Send in for it *today!*

50% STRONGER CORDS produced by the new Flexon process combat stretching. **You** can fight stretching—and the slip and heating that result—by promptly taking up any slack in your drives. Remember, V-belts working round the clock need inspection *4 times as often* as in peacetime!

20% MORE CORDS than before help protect the new Texrope Super-7 against strains and breaks. **You** can minimize breaks in your plant—whatever "make" of V-belts you use—by requiring that V-belts *never* be pried into grooves. Good rule for cutting down internal injuries!

NEW COOLER-RUNNING CUSHION of special rubber "eases" Texrope Super-7 cords around sheaves — for smoother flexing and less heat. **You** can fight heat by preventing misalignment. It causes rubbing of belt sides. So keep sheave grooves in line — shafts parallel.

☛ *When you do Need new V-belts, invest in the Best . . . Texrope Super-7!*

A 1544

ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

TEXROPE* SUPER-7 V-BELTS

*Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers. Available in all sizes.....½ h.p. to 2,000 h.p.

CORRECT SHOP PRACTICES

now more important than ever . . .

These working instructions can help save time, speed war production, and conserve vitally needed materials

T-2—Welding, Brazing and Soft Soldering of Monel, Nickel and Inconel . . . Detailed instructions on all joining processes applicable to Monel, Nickel, Inconel, Monel-clad steel, Nickel-clad steel, Inconel-clad steel, "K" Monel and "Z" Nickel . . . Instructions on jigs and clamps, welding wires and fluxes, overlaying, hard surfacing, welded linings, cleaning, heat treatment, grinding and finishing.

T-4—Methods for the Fabrication of Clad-steel Plate . . . How to make heavy, corrosion-resistant equipment from Nickel-, Monel-, and Inconel-clad steel plate. Includes instructions for working where methods differ from regular steel plate practice.

T-11—Forging Monel, Nickel and Inconel . . . Discusses the ready forgeability of these materials into almost any shape that can be forged in steel. Data on proper methods of heating dies, lubrication, mechanical properties of forgings.

T-12—Machining Monel, Nickel and Inconel . . . General recommendations on cutting feeds, speeds, depth of cut; tool design, cutting, tool steel and cutting compounds.

T-14—The Design and Construction of Heavy Equipment in Monel, Nickel and Inconel . . . Discusses problems commonly encountered and outlines proper procedure for fabricating heavy equipment from Monel, Nickel and Inconel.

T-16—The Heat Treatment of "K" Monel and "Z" Nickel . . . Indicates the mechanical properties obtained from various forms and tempers. Explains the cycles of heat treatment and the heat treating conditions necessary to obtain satisfactory results.

T-17—Fabrication of Monel, Nickel and Inconel Seamless Pipe and Tubing . . . Instructions on machining, welding, cutting-off, thread cutting, bending and coiling. Includes data on mechanical properties, bursting and collapsing strengths of full cold-worked seamless tube.

T-19—The Deep Drawing, Shearing and Perforating of Monel, Nickel and Inconel . . . Directions for shearing, perforating, blanking, cupping, drawing and other press-forming operations; die materials, lubricants, annealing, pickling and mechanical properties.

T-20—Annealing Nickel, Monel and Inconel . . . Detailed instructions for soft annealing, temper annealing and stress-equalizing annealing by open and closed methods; bright annealing, fuels, furnaces, atmospheres, temperature control, effect of cold work, grain size and mechanical properties.

T-21—Pickling Monel, Nickel and Inconel . . . Describes methods for removing oxide and tarnish from annealed shapes, etc. Includes recommended formulae for pickling solutions and pastes.

TS-5—Grinding, Polishing, Buffing Monel, Nickel and Inconel . . . How to produce any desired finish on Monel, Nickel and Inconel; proper wheels and abrasives to use, preparing glue and wheels, speeds, procedures for grinding, polishing, buffing and brushing. Includes working chart.

Spinning Monel and Nickel . . . Describes the general procedure for spinning Monel and Nickel; information on lubricants, tools, chucks, speeds, annealing, pickling, etc.

List "B". . . A complete listing of INCO technical Bulletins.

☆ ☆ ☆

Check bulletins desired, mail coupon or your request by letter to The International Nickel Company, Inc.

INCO NICKEL ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • NICKEL • "Z" NICKEL

Sheet . . . Strip . . . Rod . . . Tubing . . . Wire . . . Castings

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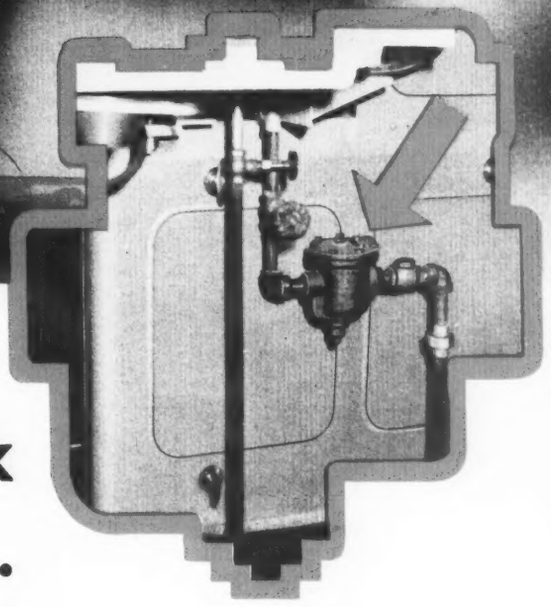
THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

☐ T-2 ☐ T-4 ☐ T-11 ☐ T-12 ☐ T-14 ☐ T-16
☐ T-17 ☐ T-19 ☐ T-20 ☐ T-21 ☐ TS-5 ☐ List "B"
☐ Spinning Monel and Nickel

*Name*_____ *Company*_____

P. 10-42

*Title*_____ *Address*_____



with **SARCO**

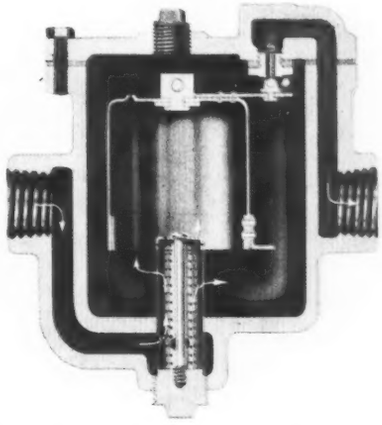
Two Floors Do the Work that Three Did Before . . .

The hurricane blew the top floor of the New England Overall Company to the ground. A rearrangement of machines—plus a speed-up produced by all-Sarco steam traps and controls—enabled this company to do more business with two floors than they formerly did with three.

The owner says:

"I'll Spend a Dollar to Save Ten Anytime.

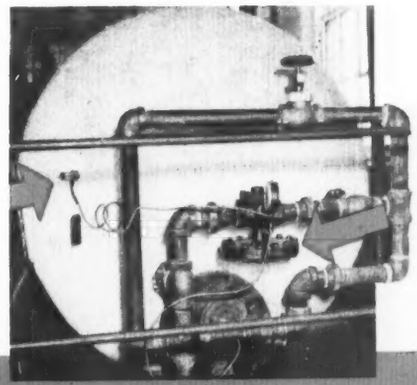
"If you have three wash wheels, you should be able to load them up all at the same time. If your plant is full of presses, pants stretchers, tumblers, etc., no one machine should be slowed up by any or all of the others. Our contractors advised a separate Sarco steam trap for each machine—we know now it would have been folly to do it any other way. Also, instead of putting in an additional hot water tank, they suggested another coil and a Sarco 2430 Regulator which gives us all the water we need and works like a charm. I know what steam costs and what it costs to have operators wait. I'll spend a dollar to save ten anytime."



Sarco Inverted Bucket Steam Traps are available for general application at pressures from 10 — 900 lbs., and for superheat. Preferred for supply lines to engines, turbines, and pumps, in refineries, laundries and for other hard service where intermittent discharge is permissible.

Catalog No. 350

Sarco 2430 Temperature Regulator

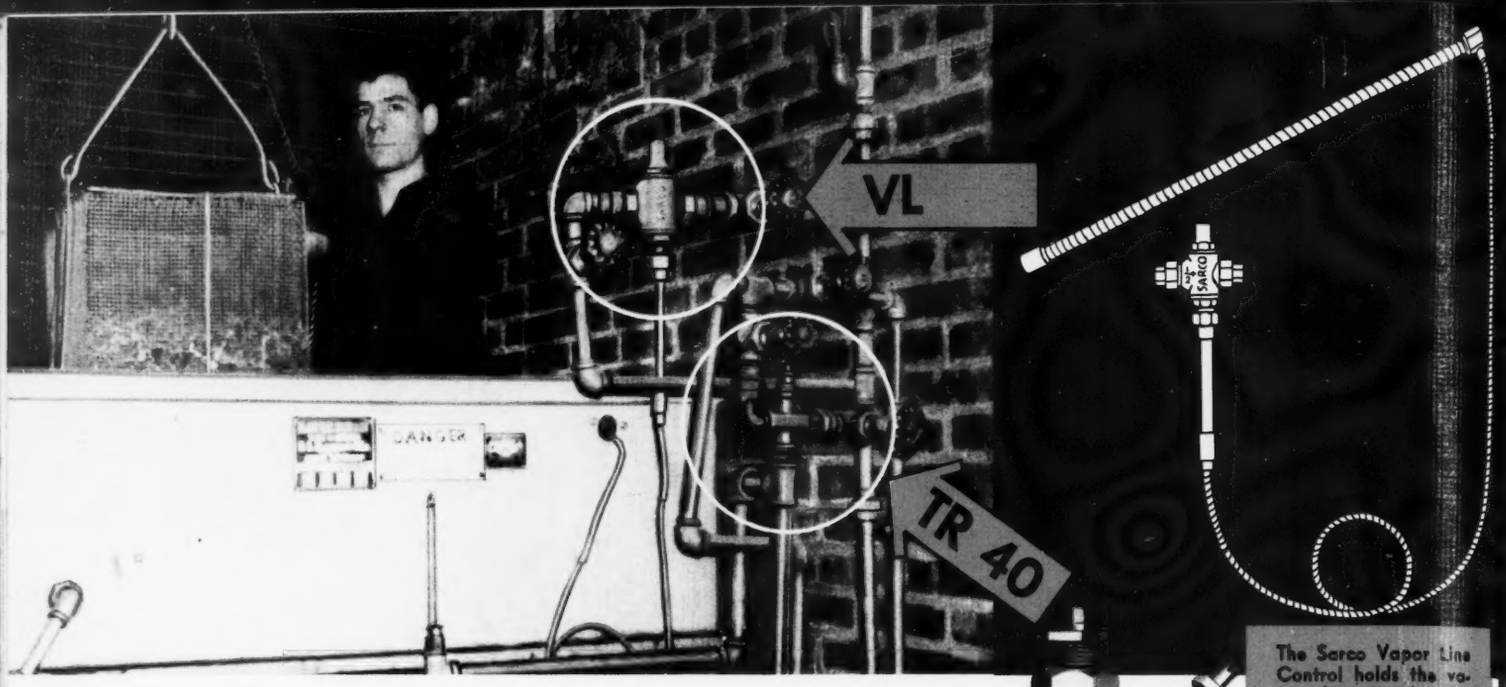


SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

Represented in Principal Cities

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONT.



More Production
with Sarco Heat Controls

Maximum production demands intelligent use of steam so that none shall be wasted.

Sarco steam traps and temperature regulators can aid mightily in this effort.

For example, take modern cleaning of metal parts as in the degreaser above. Simple self-operated Sarco valves regulate both heating and cooling coils to keep the vapor at the correct level.

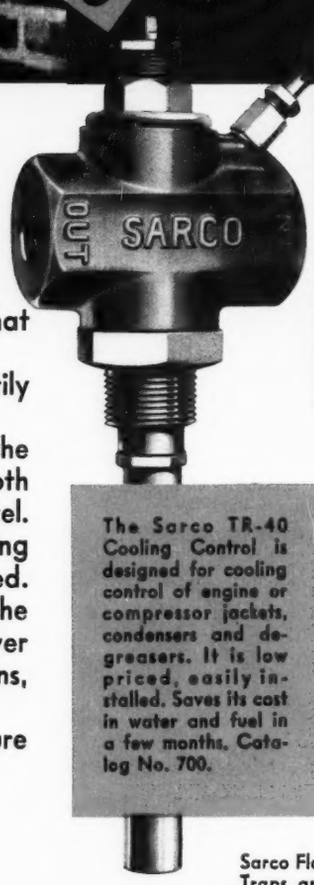
Waste of steam, waste of expensive solution, waste of cooling water, are prevented and a uniformly clean product is assured.

Or, in the simple matter of water heating; without control the water often is too hot and many wasted heat units go to the sewer with it. Fluctuating water temperatures delay process operations, cause rejects, and costly spoilage.

Sarco steam traps assure fast heating and Sarco temperature regulators prevent waste.

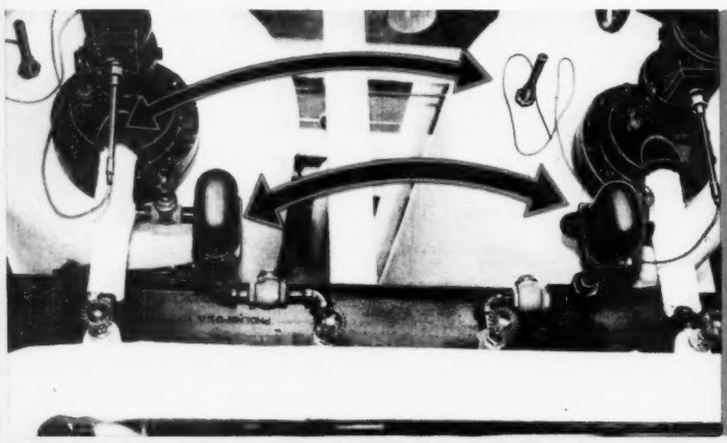
The Sarco Vapor Line Control holds the vapor line in the degreaser by regulating the temperature of the cleaning solution.

It is self-operated and requires no compressed air or electricity. The bulb is constructed with corrugated outer surface to secure very rapid response to temperature changes. Catalog No. S930.

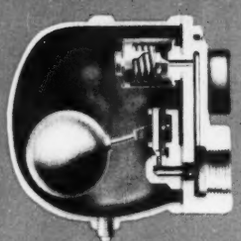


The Sarco TR-40 Cooling Control is designed for cooling control of engine or compressor jackets, condensers and degreasers. It is low priced, easily installed. Saves its cost in water and fuel in a few months. Catalog No. 700.

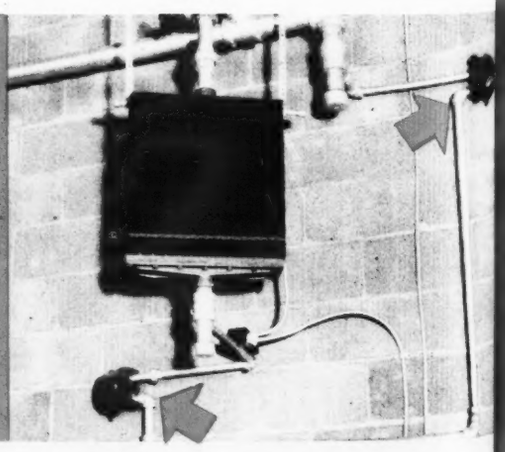
Sarco Float-Thermostatic steam traps and TR-21 Temperature Controls on hot water service.



SARCO



FLOAT-THERMOSTATIC STEAM TRAP



Sarco Float-Thermostatic Steam Traps and UL Control on unit heater.

SARCO Saves Steam

SARCO COMPANY, INC., 475 FIFTH AVENUE, NEW YORK

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

Represented in Principal Cities

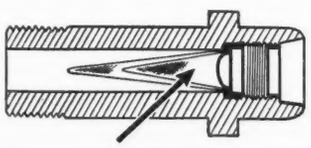
How to Make Welding and Cutting Regulators Last Longer . . . .

GOOD oxy-acetylene welding and cutting depend to a great extent upon smooth, unfluctuating delivery of gases to the blowpipe. This, in turn, depends upon the action of the regulators that reduce the cylinder gas pressure to the desired working pressures. Because of the very nature of the work they perform, oxygen and acetylene regulators must be precision-made. Moving parts must work smoothly and seating surfaces must close tightly. So—while sturdily made—Oxweld, Prest-O-Weld, and Purox regulators should be recognized as *sensitive instruments* and should be treated as such. The suggestions outlined here will help you to make your regulators last longer and work more efficiently.

KEEP DIRT OUT OF REGULATORS

1. ***Crack the cylinder valve*** slightly for an instant and then close it, before connecting a regulator to the cylinder. *This will blow dust and dirt out of the valve and will not only reduce the likelihood of forcing dirt into the regulator, but also will help to avoid damage to the seating surfaces on the regulator inlet connection.*

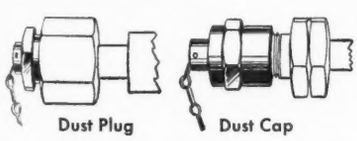
2. ***Dust screens*** are built into the inlet passages of most Oxweld, Prest-O-Weld,



Dust Screen

and Purox oxygen regulators. Do not remove these screens except for periodic cleaning, after which they always should be replaced immediately. *Be careful not to tighten the locking ring too tight as this may shear off the brass screening. Pull it up until it is just "snug".*

3. ***Dust caps*** or plugs are provided on



Dust Plug Dust Cap

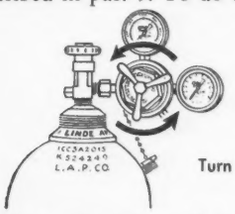
most Oxweld regulators. If your regulators are so equipped, screw them into place whenever the regulator is not attached to a cylinder. Do not remove the chains that attach dust plugs and dust caps to the regulators, as the chains prevent them from being lost.

AVOID EXCESSIVE STRAINS

4. ***When turning gas on*** after attaching a regulator, open the cylinder valve only slightly at first to avoid a sudden rush of high-pressure gas into the regulators and regulator gauges.

5. ***Always release gas pressure*** from regulators when the equipment is not being used. First close the cylinder valves. Second, open the blowpipe valves to release all pressure. Then close the blowpipe valves. *If this is not done, even a very slight leak in the regulator valve seat may permit excessive pressures to build up in the delivery chamber of the regulator and in the hose. This might result in straining the low-pressure gauge or regulator valve, or may even rupture the safety-release disk or the hose.*

6. ***Always release the pressure-adjusting screw*** after relieving the pressure as described in par. 5. To do this, turn the



Turn to Left

handle to the left until it turns freely. *This will greatly prolong the life of the diaphragm.*

MAINTENANCE SUGGESTIONS

7. ***Test for leaky valve seats*** at regular intervals. To do this, attach the regulator to a cylinder, release the pressure-adjusting screw, open the cylinder valve, and apply a film of soapy water over the regulator outlet connection. *If the regulator valve seat leaks, the gas that leaks through will blow a bubble and burst the soapy film. Do this periodically, and replace at once seats that leak. This will avoid possible extensive damage and repairs.*

8. ***If a safety-release disk breaks,*** replace it only with the correct part as specified in the instruction book supplied with the regulator. Do not use substitutes. *This is important because disks not especially made to rupture at a pressure commensurate with pre-determined safety requirements may permit pressures to build up, without being released, to a point that could do serious damage.*

9. ***Replace broken gauge crystals at once.*** If this is not done, the needle indicator may be damaged or the dial face may become so dirty that it will not be possible to adjust the regulator accurately to the pressure required for good work.

DUPLICATE INSTRUCTION BOOKS AVAILABLE

It is important that oxy-acetylene apparatus be operated and maintained in accordance with the manufacturers printed instructions. Duplicate copies of the instruction booklets packed with all oxy-acetylene apparatus supplied by Linde can be obtained from any Linde office.

The words "Linde," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street, New York UCC Offices in Principal Cities

In Canada: Dominion Oxygen Company, Limited, Toronto

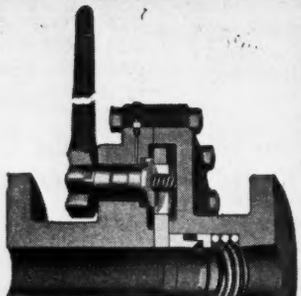
You Can Obtain Reprints Of This Page For Distribution in Your Shops . . . or to Post on Your Bulletin Boards . . . Upon Request.

BLOW-OFF

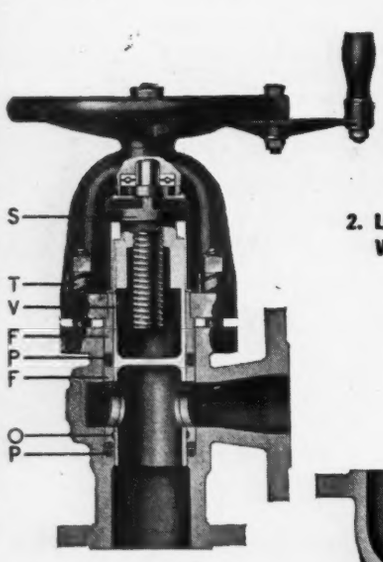
At left, Yarway Seatless and Double-Tightening Valves in Tandem, for pressures up to 250 lb

At right, Yarway Seatless Tandem for pressures up to 400 lb

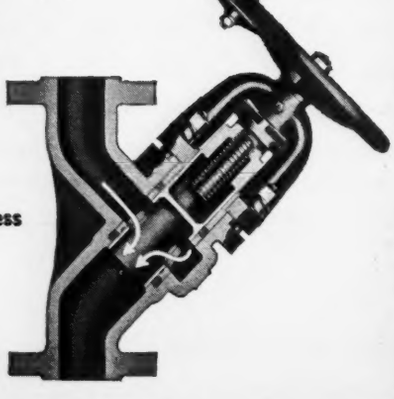
FOR EVERY



1. Right: Yarway Double-Tightening Valve



2. Left: Yarway Type B Seatless Valve, Angle Type



3. Right: Yarway Type B Seatless Valve, Straightway Type

Yarway offers a complete Blow-Off Valve Service—FOUR DISTINCT TYPES OF VALVES to answer the Blow-Down Requirements of every steam plant.

Each is the product of more than a quarter-century of mechanical and metallurgical research—of practical field experience with more than 12,000 installations—of a determination continually to lead the Industry with the finest blow-down equipment that can be produced.

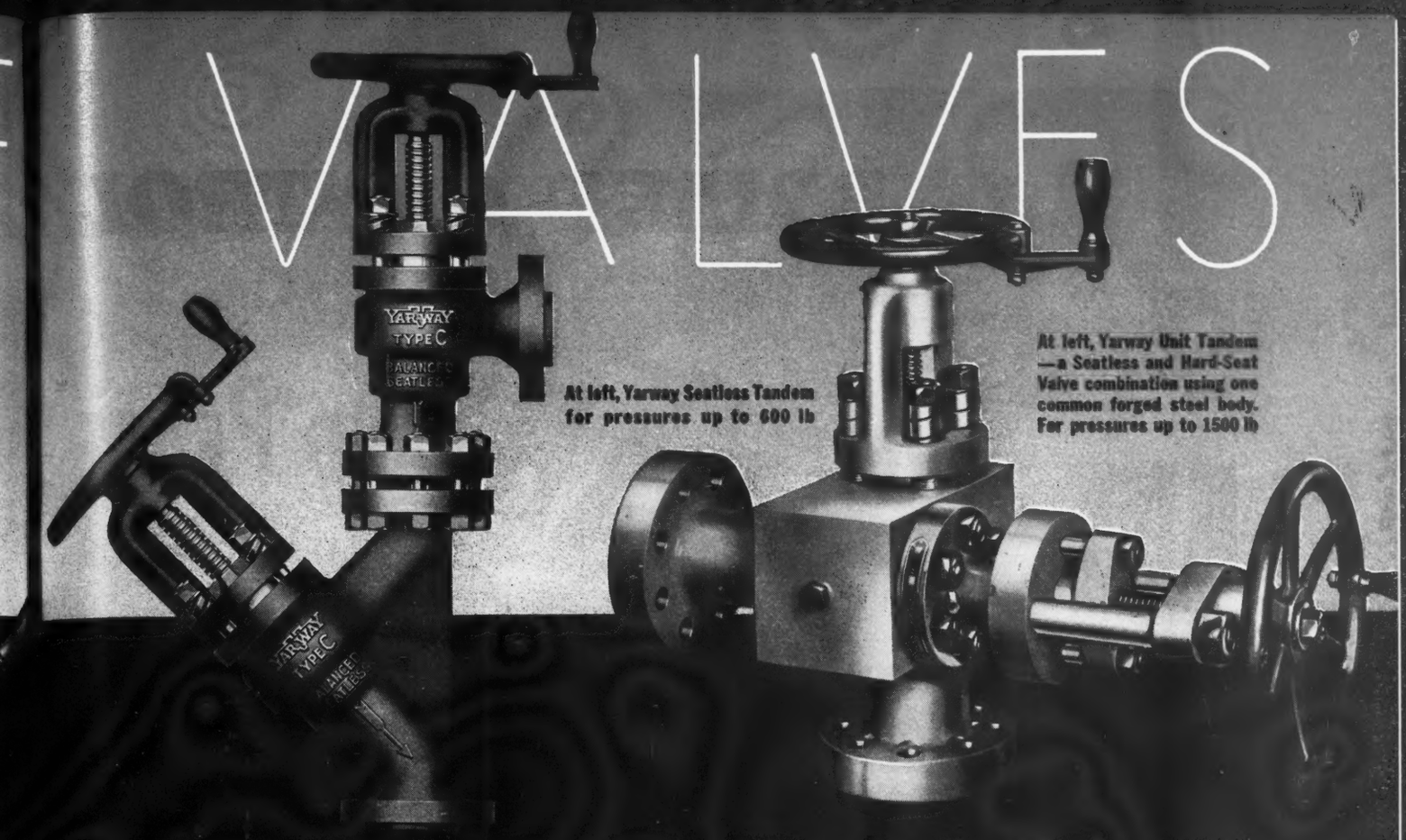
Because the Yarway line is complete you may be sure Yarway recommendations will be unbiased, based on honest judgment that the type of valve selected will give long, trouble-free, money-saving service on the job.

Write for catalog; For pressures up to 400 lb, Section 421; For higher pressures, Section 431.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY

VALVES



At left, Yarway Seatless Tandem for pressures up to 600 lb

At left, Yarway Unit Tandem —a Seatless and Hard-Seat Valve combination using one common forged steel body. For pressures up to 1500 lb

PRESSURE

Yarway Double-Tightening Valves (Fig. 1) are of lever-operated swing gate design with unique feature of sealing bushing on inlet side, making valve double-tightening on both sides of disc. When open there is a straight through passage for unobstructed flow.

•

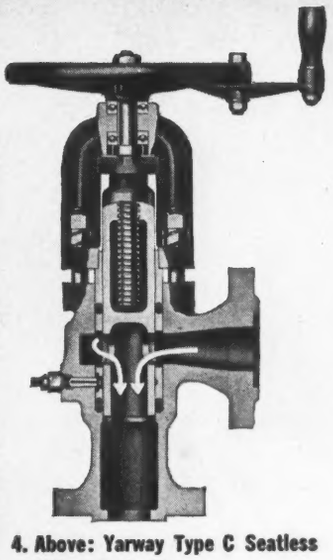
Yarway Type B Seatless Valves are of balanced, sliding plunger design. Made in Angle (Fig. 2) and Straightway (Fig. 3) Types. Operation of Yarway Seatless Valves: After valve is closed, shoulder S on plunger V contacts with upper follower gland F, forcing it down into body and compressing packings P, above and below port, making an absolutely tight valve. Yoke springs T maintain continuous pressure through follower glands F, on packing rings P. Annular groove O connects with alemite fitting for lubricating plunger and packing; alemite lubrication also provided for stem.

•

Yarway Type C Seatless Valves (Fig. 4) are made in both angle and straightway types. In this design the longer plunger protects the packing from blow-down at all times. Other features are laminated packing with stainless steel inserts, nitralloy plungers alemite lubrication, ball thrust bearings.

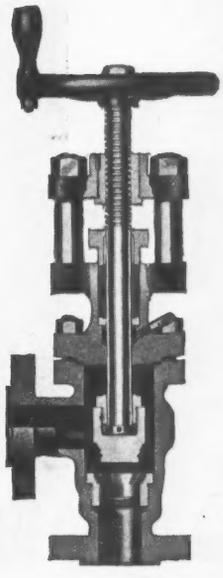
•

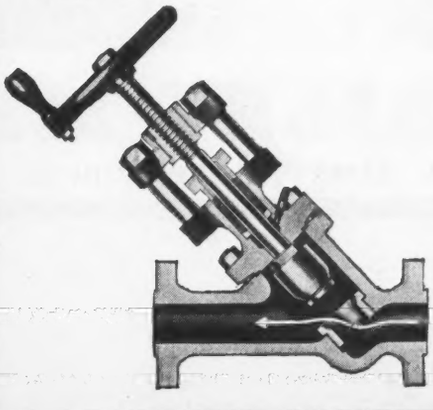
Yarway Hard-Seat Blow-Off Valves are of cone seat and disc type, having metal-to-metal contact. These valves are made in angle type (Fig. 5) and straightway easy flow type (Fig. 6). Features of the Yarway Hard-Seat Valve include: Marine and cast steel type yoke with threaded bushing, packing gland with bronze liner, large packing space, long-shank stem. Disc and seat ring are stainless steel; beveled faces have stellite inserts which provide smooth, hard-wearing surfaces at this important point.



4. Above: Yarway Type C Seatless Valve, Angle Type

5. Below: Yarway Hard-Seat Valve, Angle Type



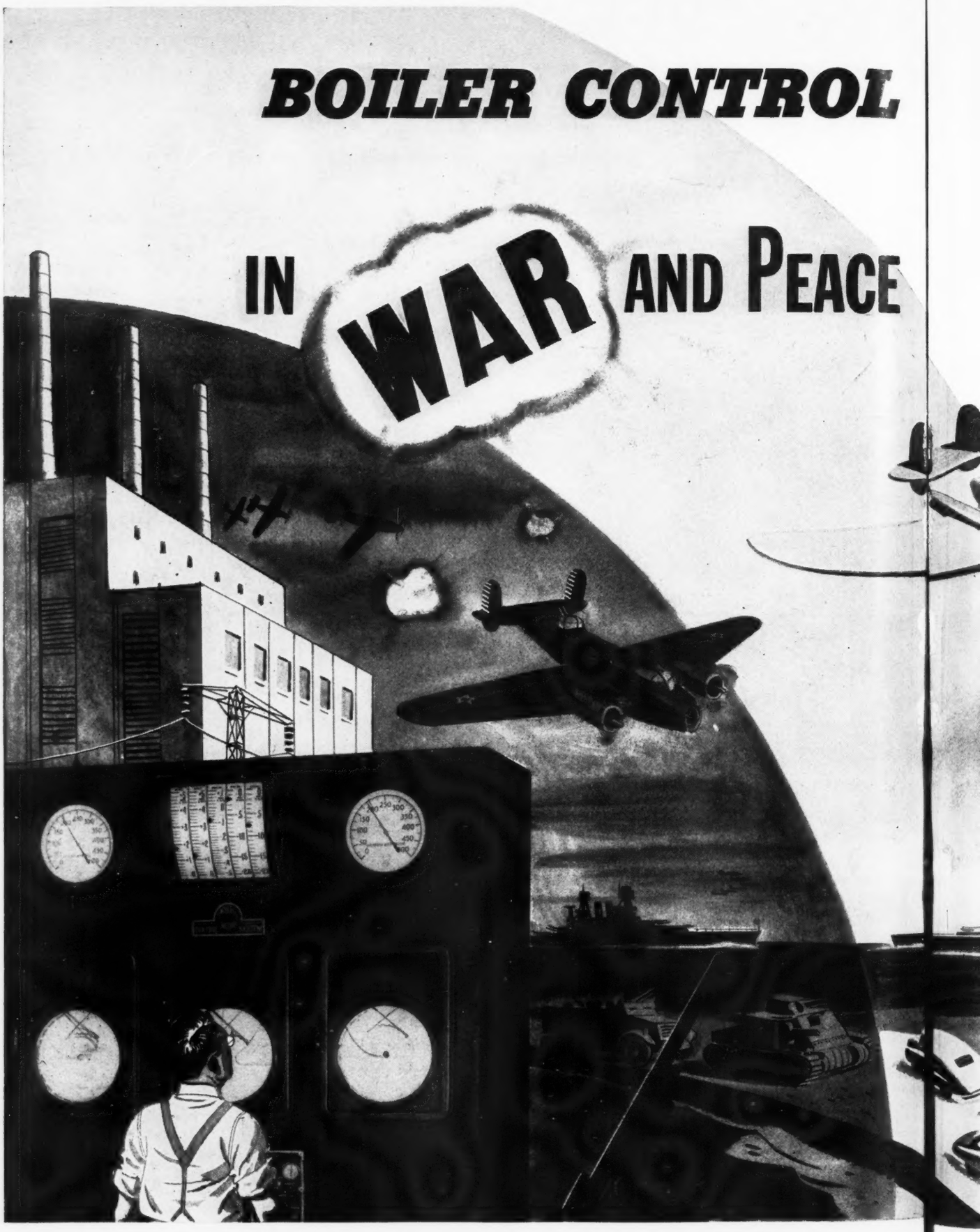


6. Left: Yarway Hard-Seat Valve, Straightway Type

BLOW-OFF VALVES

BOILER CONTROL

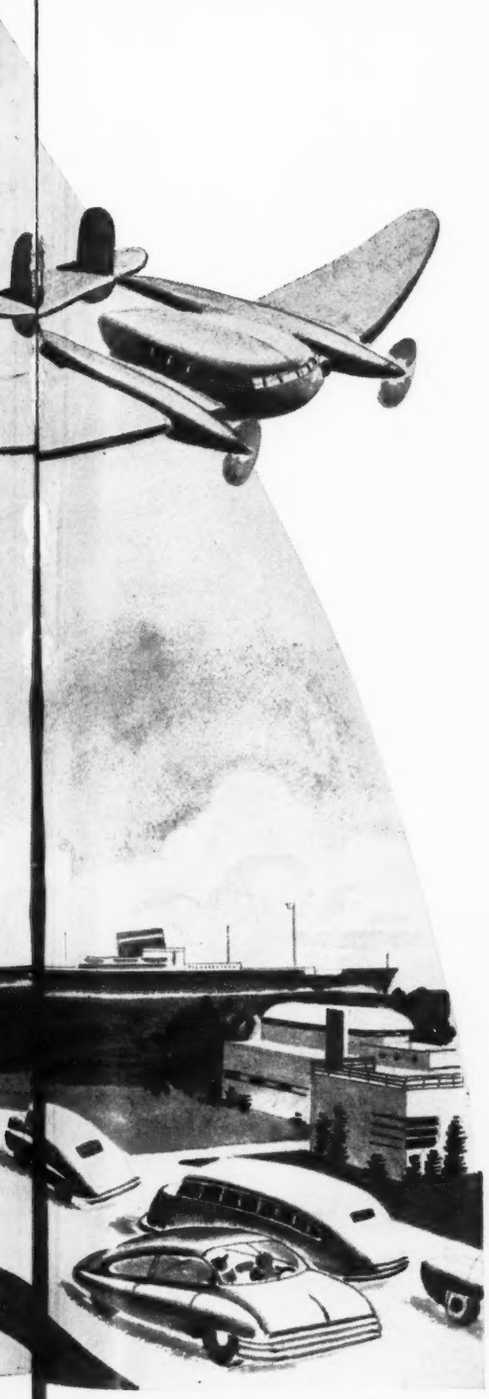
IN WAR AND PEACE



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

SPEEDS PRODUCTION



★ ★ ★

The same Bailey Boiler Control which is today helping American industry to deliver a flood of war material will continue to serve its users after the war.

When raw materials again flow to the goods of peace, this complete boiler control system will help many fortunate manufacturers to produce better products at lower cost.

But now, Bailey Control serves the war effort by:

1. Improving Continuity of service by continuously maintaining Combustion, Feed Water Flow, Steam Temperature, Heater Levels, Pump Pressure and other factors at optimum values.
2. Making full boiler capacity available by continuously and automatically maintaining excess air at the minimum economical value and by indicating when cleaning or repairs are necessary for boilers and furnaces.
3. Automatically maintaining ideal conditions while new boiler operators are in training.
4. Easing of transportation loads by the economical use of fuel which results from a co-ordinated control system.
5. Protecting men and equipment against accidents by the use of interlocks and alarms in the boiler control system. Serious accidents resulting from fan failure, flame failure, high or low water levels and other unusual conditions may be avoided by these devices.

Numerous suggestions on War Time Boiler Plant Operation are contained in the bulletin, "How to Safely Stretch Steaming Capacity." To obtain a copy, simply ask for Bulletin No. 16.

A-85

BAILEY METER COMPANY

1036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

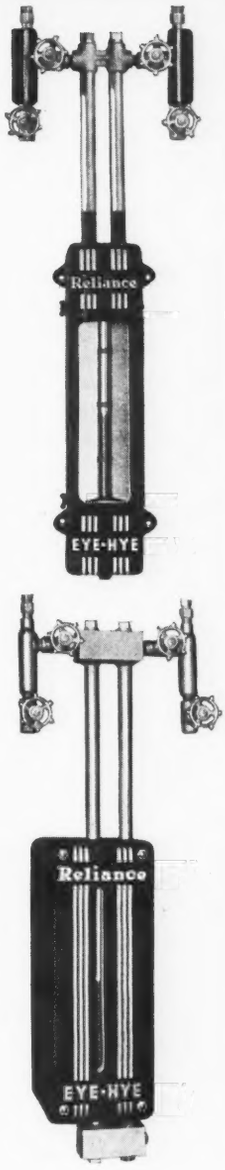
CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Blackout!

Reliance

but you can avoid the risk of blacking out your water level supervision

Reliance EYE-HYE is self-illuminated —brings safe clear reading to control stations remote from windows— never leaves water levels unguarded



WHEN IT'S "LIGHTS OUT" in the power plant there's a whale of a lot of *blackness* to contend with, as you've probably already learned. But you don't fear water level accidents from lack of supervision when Reliance EYE-HYE is on guard.

This popular remote reading indicator brings the gage *down* to a safe, convenient position at *eye level.* It shows the water in illuminated green liquid and the steam or empty space in clear white light — an accurate, easy-to-read indication, yet without tell-tale spread of light. EYE-HYE's flexibility of placement — almost any distance or direction from the drum — means it can be far removed from windows if necessary. And installing or re-locating is an easy job.

Thousands of EYE-HYEs carry true water level indication to operating floor locations in busy plants and on ships, providing step-saving, worry-preventing water gage reading. Supplied for any working pressure, for either wall or panel mounting.

It's a safe bet that operators in plants equipped with Reliance EYE-HYE won't have water level jitters when blackouts come. Write for Bulletin 382-C — no obligation!

THE RELIANCE GAUGE COLUMN CO. • CLEVELAND, OHIO

BOILER SAFETY DEVICES

how to get the most service

For plants operating moderately-sized and smaller steam generating units. High-pressure, high-temperature units with fully water-cooled furnaces require special consideration.

If your steam generating units include superheaters, it is well to remember that this important equipment, too, requires care and attention if it is to deliver the trouble-free service for which it was designed. All too frequently, the superheater, hidden away among the boiler surfaces, is deprived of the attention normally given to the boiler and firing equipment. Don't wait for erratic performance or an actual failure of a superheater element to warn you of the necessity of correct operation and regular care of your superheaters.

OPERATION

So long as there is a fire in the furnace of a superheater-equipped boiler unit, adequate protection must be provided for the superheater. This is especially important when there is normally no demand for steam such as when starting up and shutting down. Most warpage of superheater elements and many of the failures occur as a result of improper operation during these periods.

The manufacturers provide suitable means for assuring this protection by supplying drain valves on the headers and safety valves on the outlet header. However, the purpose and use of these valves must be thoroughly understood and they must be properly operated to assure full protection. Recommended procedure follows.

There are three periods of operation during which the superheater must be given special attention: starting up, bringing the boiler on the line, and banking the boiler or shutting down.

(1) When starting up be sure the drain valve on the superheated-steam header has a free blow to the atmosphere through piping not smaller in size than the valve. This line should be independent of the boiler blowdown line, and should not discharge at a location that would make the escaping steam dangerous or disagreeable to the operators.

(2) When bringing the boiler on the line be sure that the saturated steam header drain is closed and the superheated steam header drain is open until the boiler is cut in on the line, whereupon the latter drain should be closed also. Steam must flow through the superheater elements at all times so as to maintain element temperatures within the limits for the metals used.

(3) When banking a boiler for standby service it is recommended that the superheated-steam header drain valve be opened to provide an adequate flow of steam through the superheater until furnace gas temperature has been sufficiently reduced to assure its protection. This is especially desirable where frequent banking periods are required.

(4) The purpose of the safety valve on the superheated-steam header (set from 3 to 5 lb below the lowest set boiler safety valve) is to assure adequate steam protection to the superheater if the steam demand drops suddenly and unexpectedly. When this occurs, reduce the firing rate immediately to conform with load requirements as the superheater safety valve is usually not designed to maintain safe steam temperatures indefinitely.

CLEANLINESS

Where conditions require that units be kept in service for extended periods, it is essential that suitable arrangements be made to assure cleanliness of the external superheater surfaces. This may be accomplished by properly located soot blowers or by hand lancing with air at regularly scheduled intervals. Dust accumulation results in unequal gas distribution, inefficient heat transfer and possibly localized overheating.

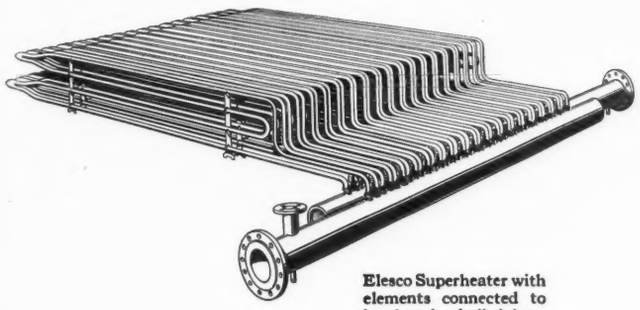
Proper feedwater treatment and control of steam quality and carry-over are essential to assure cleanliness of interior surfaces of superheaters. Overloads, fluctuating load, high water level, foaming, high concentrations, etc. all contribute to deposits on interior surfaces. Accumulation of these deposits cuts down heat transfer and increases pressure drop across the superheater. Unless dealt with effectively, ultimate failure of elements may occur. Consult manufacturer for corrective recommendations.

Periodic checks of steam pressure drop across the superheater will usually indicate whether or not solid deposits are present within the elements. A single pressure gage connected to both inlet and outlet headers and fitted with valves in both lines provides a simple method. Readings must be taken under identical load conditions.

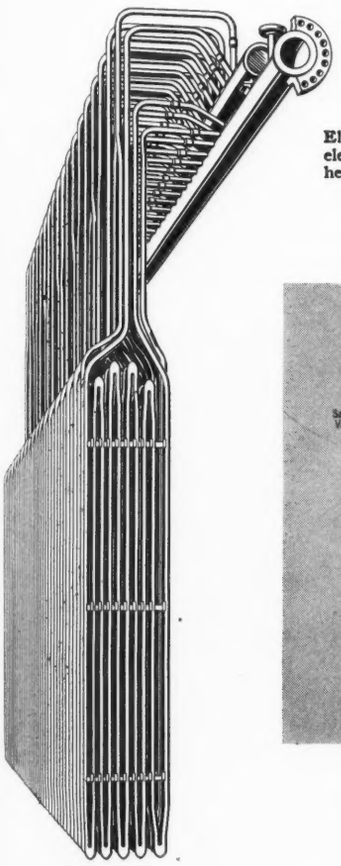
C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION

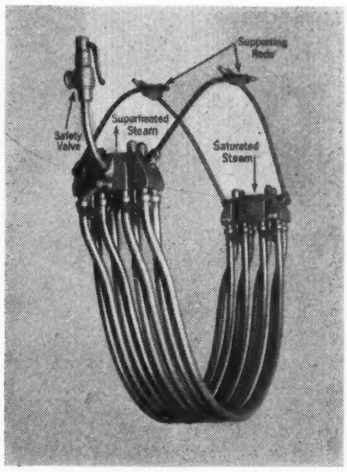
out of your superheaters!



Elesco Superheater with elements connected to headers by ball joints.



Elesco Superheater with elements connected to headers by welded joints.



Elesco Girth Superheater designed for Horizontal Return Tubular Boilers.

INSPECTION AND MAINTENANCE

A regular inspection and maintenance program conscientiously followed will do much to assure continuity of service and to avoid serious and expensive outage. A supply of spares on hand is good insurance against prolonged outage for repairs.

In the event of the failure of one or more elements, it is well to check carefully to determine the cause. The manufacturer will be glad to assist you and to suggest proper means to prevent recurrence.

The following inspection and maintenance routine is recommended.

(1) The superheater should always be inspected when the boiler is inspected.

(2) Check the elements for alignment and any evidence of warping or bulging. Replace as promptly as possible elements that show serious warping, bulging or other evidence of overheating.

(3) Check supports, spacers, baffling and seal plates for proper location and condition. Repair or replace promptly.

(4) Check joints at headers for tightness. Eliminate leaks promptly to avoid damage to seats.

(5) Check inside surfaces of headers and steam drum for evidence of solids carry-over. If present, take immediate steps to eliminate cause. When in doubt consult manufacturer.

(6) Check location and condition of soot blowers in immediate vicinity of superheater elements. Make sure that nozzles are in proper alignment and that the correct steam pressure is being used so that steam jets are not cutting the superheater elements.

There is no place in the Victory Program for idle equipment, particularly enforced outages due to careless operation and inadequate attention. Keep *your* units "on the line" through proper operation, regular inspection and prompt maintenance.

Over 100,000,000 boiler hp in the stationary, marine and locomotive fields have been equipped with Elesco Superheaters.

Reprints of this advertisement are available upon request.

A-684

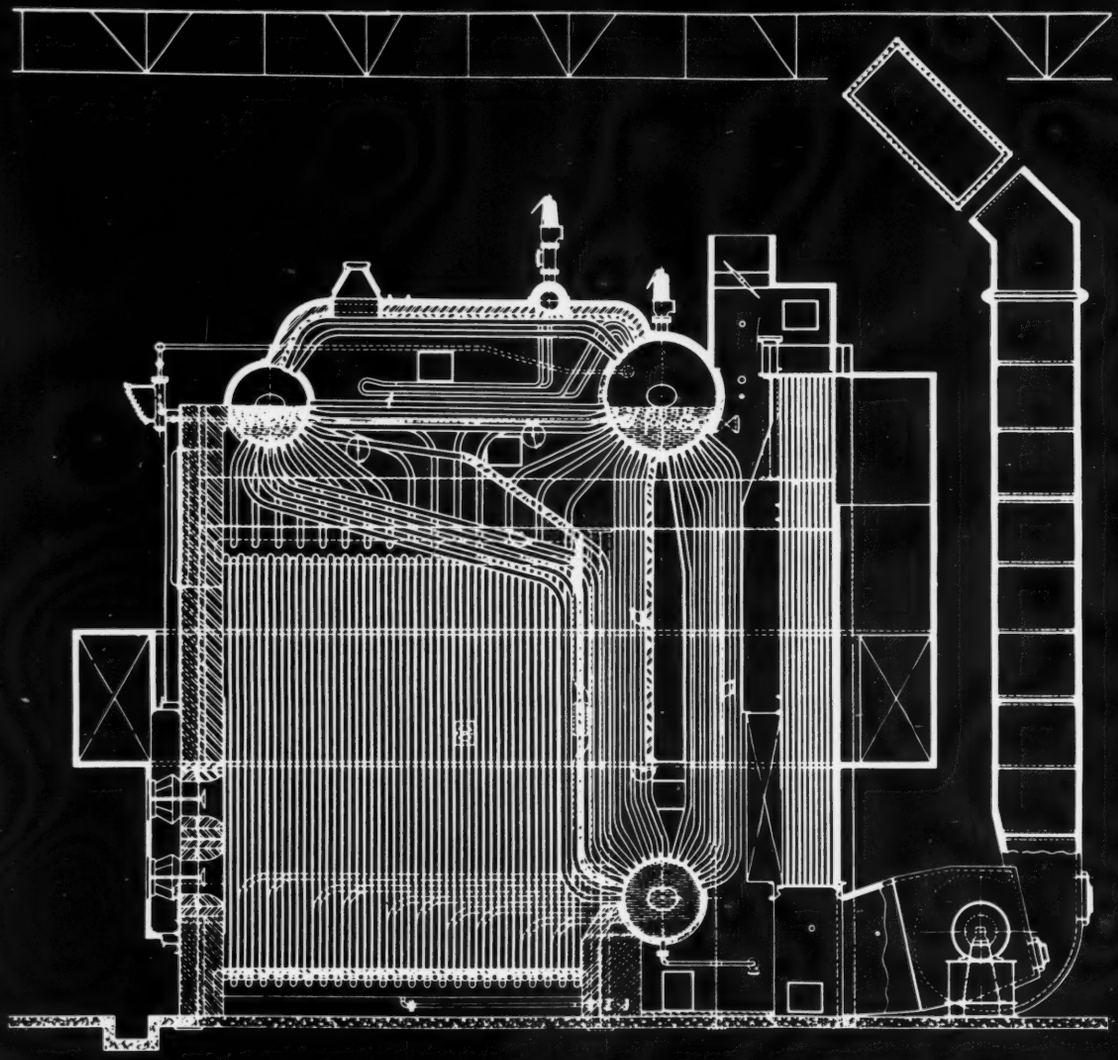
COMBUSTION ENGINEERING COMPANY, INC., 200 MADISON AVENUE, NEW YORK, N. Y. • CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

ENGINEERING

A Recent EDGE MOOR
RADIANT HEAT BOILER INSTALLATION

— at Philadelphia, Pa. —

WHICH CAN BE DUPLICATED PROMPTLY *ANYWHERE*



This installation consists of 4 — 900 H.P. radiant heat bent tube boilers for 275# pressure and 430° total steam temperature. Boilers are oil fired and equipped with superheaters, water walls and air preheaters. Each unit is capable of developing 110,000# of steam per hour.
These units are a good example of Edge Moor's contribution to the war effort and can be duplicated promptly and without delay from designs already developed and approved.

Complete installation service is available through Edge Moor including boilers, superheaters, water walls, economizers and air preheaters.

EDGE MOOR IRON WORKS, INC. 30 ROCKEFELLER PLAZA NEW YORK, N.Y.

KANSAS CITY CHICAGO DETROIT RICHMOND, VA.

IN CANADA:— UNITED STEEL CORPORATION, LTD., TORONTO, MONTREAL

BETTER CHECK NO. 2 MOTOR BILL—IT'S RUNNING HOT
OKAY! I'LL TAKE THE AK-1 FOR THAT JOB
THE RIGHT INSTRUMENTS MAKE TROUBLE-SHOOTING A CINCH

Which OF THESE HANDY INSTRUMENTS DO YOU LACK?

Type AK-1 Hook-on Volt-ammeter (A-C) Here's the handiest type of instrument for quick load checks. Forget about cutting conductors or interrupting service. Just hook it around the line, flick the selector switch to AMPERES, and you have your measurement. It measures volts also—connect the voltage leads, snap the switch to VOLTS, and take your reading. Accuracy, ±3 per cent. (Bulletin GEA-2950.)

Type AP-9, Medium-size A-C Portables—and Type DP-9, D-C You'll want this instrument for jobs requiring a high degree of accuracy—it's accurate within ¾ of one per cent. It is very portable—size only 2½ by 6½ by 4¾ inches. Available in a-c ammeters, voltmeters, milliammeters, and wattmeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-1784.)

Type AS-5, Pocket-size A-C Portables—and Type DS-5, D-C This one fits easily in a coat pocket (size, 2 by 3½ by 5½ inches), yet it is accurate within one per cent. Available in a-c ammeters voltmeters, and milliammeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-1784.)

Type CF, Inkless Recorders (Portable) Often, a chart record of load or voltage conditions over a period of time is needed to study the duration of peaks and the time when they occur. The CF line is ideal for this purpose. They're *inkless*—ready to go at a moment's notice—no pen to start, no inkwell to fill, and no ink to spill and blur the record. They weigh only 12 pounds. They are very accurate—a-c voltmeters, within 1½ per cent; ammeters, within 2 per cent. Available in a-c ammeters and voltmeters; and d-c ammeters, voltmeters, milliammeters, microammeters, and millivoltmeters. (Bulletin GEA-3187.)

New Low Chart Speed You can now get a 30-day record on a 30-inch chart—with our new one-inch-per-day chart speed. This simplifies survey analysis. Speeds of 1, 2, and 3 inches per hour can be obtained for applications requiring a higher chart speed.

Type CD, Ink Recorders (Portable and Switchboard Types) These recorders are ideal for those applications where a high degree of accuracy is very important. Either ink type or inkless. They are available in a-c ammeters, voltmeters, wattmeters, power-factor meters, and frequency meters; and in d-c ammeters, voltmeters, milliammeters, millivoltmeters, and wattmeters. (Bulletin GEA-1061.)

Current-measuring Sets (A-C) Any of the above ammeters can be supplied equipped with a split-core current transformer—the AK-1 has the transformer built in. Thus you can obtain the "hook-on" advantages in these other instruments, too, for load measurements.

These are but a few of the many instruments General Electric can furnish to measure any electrical quantity. If you want information about other instruments, we'll be glad to supply it. Ask the nearest G-E office, or write to General Electric Company, Schenectady, N. Y.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in five plants manufacturing naval equipment

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

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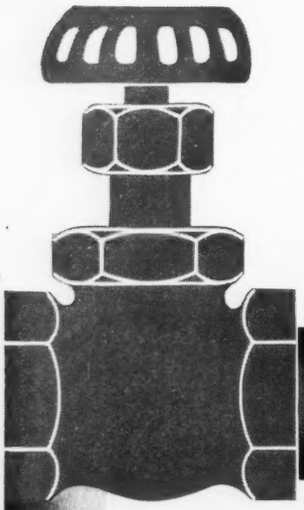

A Time-Sa

FOR THOSE ALL-IMPR

In these critical times when uninterrupted production is all-important, every minute saved in maintenance means more productive hours.

Lunkenheimer "N-M-D" (non-metallic disc) Valves cut maintenance time to the bone, because it's only a matter of minutes to renew a worn disc and keep the valve on the job.

Users of Lunkenheimer Valves are profiting from their wise policy of buying highest quality. They are getting continual tangible evidence of what really good valve performance means in dependable and low-cost service.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings and proper "end use" Allocation Classification Symbols on their orders. This will be of mutual helpfulness.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

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LUNKENHEIMER

...swing Valve

...PORTANT PRODUCTION LINES

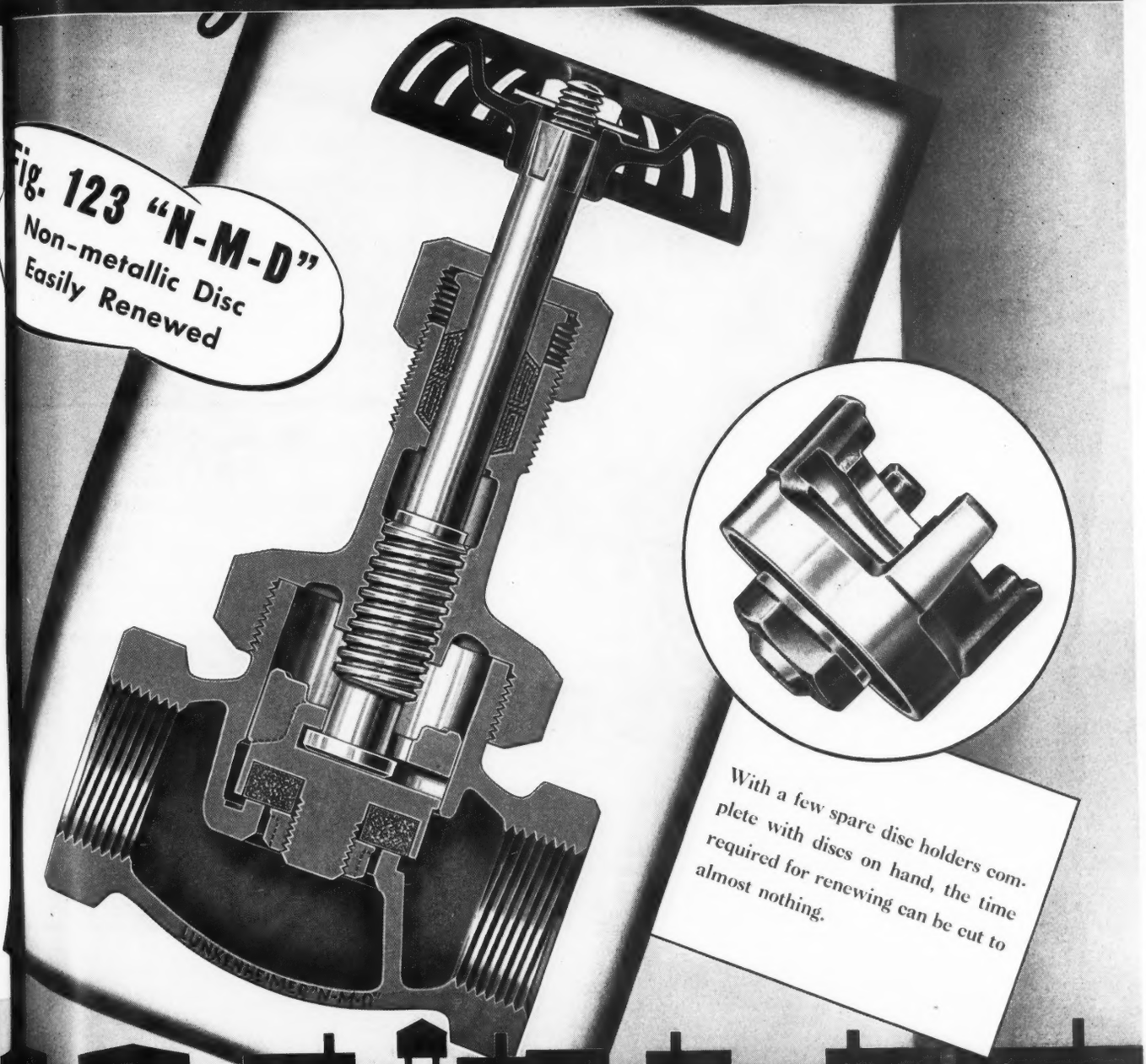
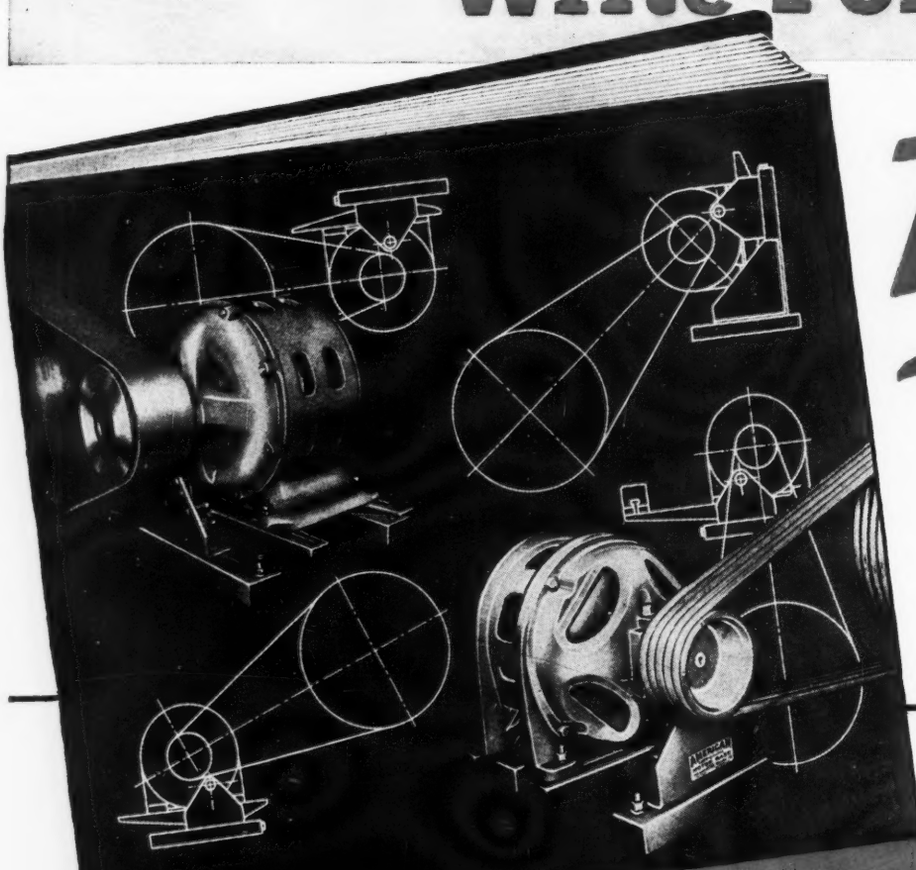


Fig. 123 "N-M-D"
Non-metallic Disc
Easily Renewed
With a few spare disc holders complete with discs on hand, the time required for renewing can be cut to almost nothing.

...ALVES BOILER MOUNTINGS LUBRICATING DEVICES

No. 8-23-42

The Book You Ought to Write For



Today!

Econ-O-Matic DRIVES

are AMERICAN Short-Center DRIVES, either flat-belt or V-belt, with AMERICAN Econ-O-Matic MOTOR BASES for automatic tension control—and thus automatic economy.

AMERICAN Econ-O-Matic DRIVES

36 Pages
Fully Illustrated

AMERICAN PULLEY COMPANY,
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Please send me free copy of the 36-page book, "AMERICAN Econ-O-Matic DRIVES".

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36 Factual Pages on the Selection of Better Short-Center Drives

TELLING YOU—

- How to select Belt Drives that will deliver full use of your horsepower and give you increased production—as demanded by the Conservation Program and the War Needs.
- How to install Belt Drives that will handle high overloads without slip or damage to the belt.
- How to double belt life.
- How belt tension can be automatically regulated to meet changing load requirements—without maintenance attention.

THESE ANSWERS AND OTHERS ARE IN THE FREE BOOK—

AMERICAN *Econ-O-Matic* DRIVES

This practical 36-page illustrated book gives all the answers why every belt-driven machine deserves an Econ-O-Matic Drive.

It is designed for executives, engineers and shop-men concerned with the most economical use of power ... with the need of conserving power, increasing production, getting the utmost service from hard, if not impossible to replace equipment ... under wartime conditions.

Accurate dimension tables and costs are included, to enable you to fit data to your problems.

The book is free—filled with valuable suggestions and factual information—much of which will be new to you. Mail the coupon for your copy today!

Navy "E" for Excellence
Awarded Feb. 12, 1942

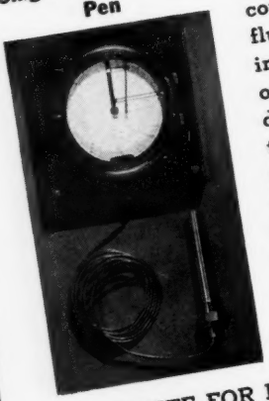
The American Pulley Company

4242 WISSAHICKON AVENUE PHILADELPHIA, PA.

B. t. u. Savers – *that will*

RECORDING THERMOMETERS

Remote Reading—Single and Multiple Pen

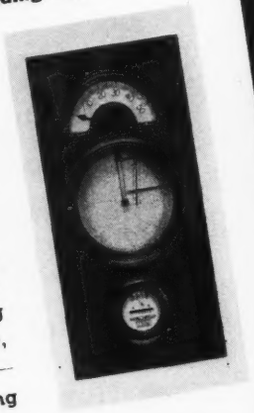


Republic thermometers are available for recording temperature of flue gas, temperatures in vats or tanks either open or closed and under pressure, temperatures in pipe lines, refrigeration systems, ovens, kilns or ducts. For unusual conditions, special bulbs are furnished of corrosion resisting metal or with a protective coating.

WRITE FOR DATA BOOK No. 210

FLOW METERS

Electrical Remote Reading Type

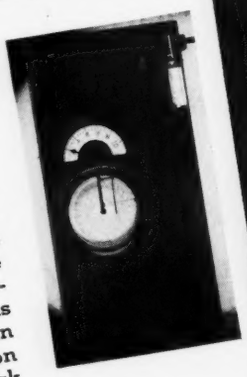


Republic electrical type flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for metering fluids at line pressures up to 10,000 lb. per sq. in. and for all ranges of differential pressure. The reading instruments — indicator, recorder and integrator — are of the remote reading type.

WRITE FOR DATA BOOK No. 701

CO_2 METERS

An Automatic Orsat—For Checking Combustion Efficiency

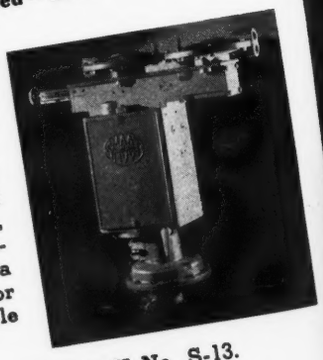


For every fuel and boiler, there is a definite percentage of CO_2 in the flue gas that will assure highest combustion efficiency. Less than this amount indicates an excess of combustion air, causing high stack loss. The CO_2 meter is the only method of accurately determining combustion efficiency.

WRITE FOR DATA BOOK No. 403

REGULATORS

Pressure — Flow — Speed — Level — Ratio



Republic hydraulic or pneumatic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, level of a liquid or the proportioning of two pressures, flows, etc., in a fixed ratio by mechanically operating a valve, damper, rheostat or various types of variable speed transmissions.

WRITE FOR DATA BOOK No. S-13.

BOILER WATER LEVEL CONTROL

Sensitive — Powerful — Stable — Rugged

The Republic boiler water level control system has been especially designed to meet the requirements of modern boiler operation. It is designed to maintain boiler drum water level within ±1 inch of the desired level under normal conditions.

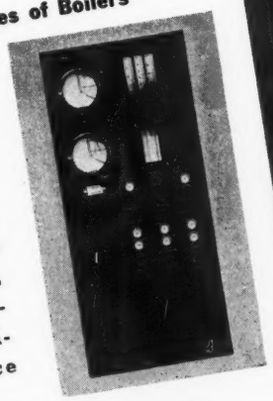
WRITE FOR BULLETIN No. S-50

REPUBLIC
INSTRUMENTS
AND CONTROLS

help you stretch wartime plant capacity

COMBUSTION CONTROL

For All Sizes and Types of Boilers

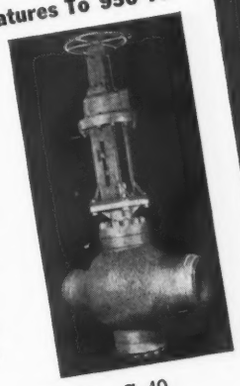


Republic automatic combustion control is available for all sizes of boilers, all types of fuel firing, all load conditions and any arrangement of draft equipment. It maintains constant steam pressure, highest combustion efficiency, desired load division, constant furnace draft.

WRITE FOR DATA BOOK No. S-21

PRESSURE REDUCING AND REGULATING VALVES

Pressures To 2500 lb.—Temperatures To 950 F.



Republic turbine type valves are of the gradual-opening, high-lift type. They are built in accordance with A.S.A. standards and can be supplied for all pressures up to 2500 lb. per sq. in. and for temperatures up to 950 F and for any specified capacity. Republic valves will regulate down to 2% of maximum flow.

WRITE FOR BULLETIN No. S-40

DRAFT AND PRESSURE INSTRUMENTS

Diaphragm Actuated Any Number and Combination

Proper regulation of draft is one of the most important requirements in obtaining highest combustion efficiency. For indicating and recording drafts, pressures and differentials, Republic dry-bellows type indicators and recorders are supplied for all ranges encountered in furnace operation, in any desired combination.

WRITE FOR BULLETIN No. 802

FLOW METERS

Mechanical Float Type

The Republic mechanical float type meter is a simple, accurate metering device for measuring the flow of steam, water, gas, compressed air, oil, brine and other fluids. It has been designed primarily for installations where remote registration is not required.

WRITE FOR BULLETIN No. 312

DESUPERHEATERS

Built To Meet Your Specific Requirements. Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters. These are of the venturi type, with ratio or ratio-tank control, the steam atomizing type and the mechanical atomizing type.

WRITE FOR DATA BOOK No. S-35

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

The TERRY

GRABBING A

This 1500 KW Terry unit is equipped with the Terry solid one piece wheel. The buckets, as shown above, are milled from the solid metal. There are no parts to work loose. • • • The blades have large clearances and are further protected by the projecting rims at the sides of the wheel. These rims would take without damage any rubbing that might occur if the radial clearance became reduced. • • • End play can do no damage to the blading as the side clearance is very large (about one inch). There is no end thrust since the steam enters and leaves the wheel in a direction at right angles to the shaft. • • • Such sturdy rotor construction makes for long life and low maintenance.

The quick starting Terry turbo alternator unit, shown at th right, is installed in a recentl completed West Coast centra station. Normally, the station aux iliaries are supplied with electri power from a house service tran former. During periods of lo system frequency or in case o failure of the house service, th auxiliary load is taken over b the Terry unit.

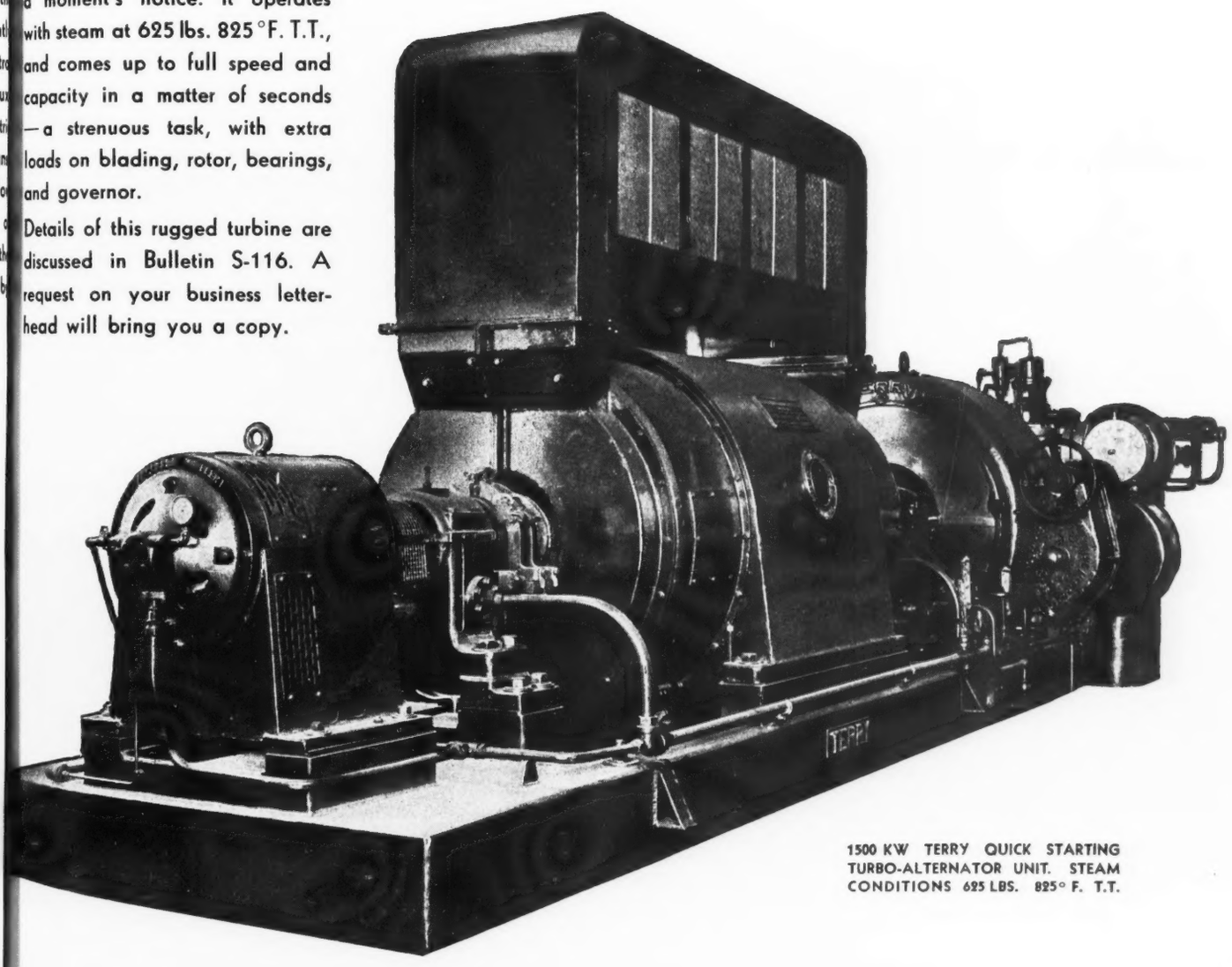
THE TERRY STEAM TURBINE CO.

Wheel Turbine

1500 KW LOAD ON A MOMENT'S NOTICE!

The unit is ready to take over on a moment's notice. It operates with steam at 625 lbs. 825°F. T.T., and comes up to full speed and capacity in a matter of seconds—a strenuous task, with extra loads on blading, rotor, bearings, and governor.

Details of this rugged turbine are discussed in Bulletin S-116. A request on your business letterhead will bring you a copy.



1500 KW TERRY QUICK STARTING TURBO-ALTERNATOR UNIT. STEAM CONDITIONS 625 LBS. 825° F. T.T.

T-1150

TERRY SQUARE-HARTFORD, CONN.

IN 1849••

Horsley and Ogston in Great Britain were still wrestling with the problem of removing Calcium and Magnesium from boiler feed waters through the use of phosphates.

IN 1883•••

Soda Ash was reported for the same purpose and for the next 50 or so years formed the base of most all feed water treatments.

IN 1935•••••

The Laboratories of the Cyrus Wm. Rice Company, then a pioneer in water treatment, concluded experiments with protein acid phosphates, seeking an improvement over the then common practice of using soda acid phosphates, and announced a startling success early this year.

NOW IN 1942•••

Seven years after its development this new organic Colloid, known as PHOSCALOID, containing 43% P_2O_5, has won the approval of many engineers in all parts of the U. S.

CYRUS W. RICE & CO., INC.,

Result?

Boiler Scale and Feed Line Deposits NO LONGER THE TOUGH PROBLEMS, THEY WERE

Because PHOSCALOID attacks the solution of Silica problems from every angle, in which the phosphate ion removes calcium and protein through its reactive, absorptive, and mechanical means, definitely keeps the chemical precipitates in the liquid state, and thus effectively removes them through the boiler blow downs.

Also, PHOSCALOID, being both basic and acid in its properties, forms either calcium proteinate or protein phosphate, and thus provides means for the full phosphate conditioning of over-alkaline treated waters from softeners without adding additional sodas to these waters.

And—PHOSCALOID does the job at costs frequently at 40% less than other phosphates.

The complete story of the development and success of PHOSCALOID is told in a little booklet ready to be mailed to you. Write for a copy.

CYRUS W. RICE & COMPANY, INC.—PITTSBURGH, PA.

You may send me a copy of "Silica vs. Phoscaloid"—the Story of Phoscaloid's Development.

NAME

COMPANY

ADDRESS

CITY

STATE

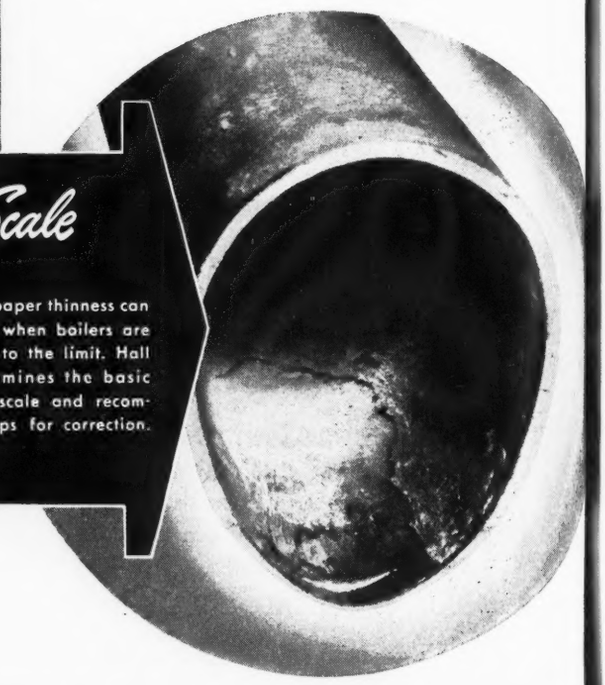
Pittsburgh, Pa.

These enemies of your st

But you can li

1. Corrosion

Boiler tubes and piping are often destroyed in a few months by corrosion or pitting. Correct treatment of water would prevent this sabotage.



2. Scale

Even scale of paper thinness can be dangerous when boilers are being pushed to the limit. Hall Service determines the basic cause of the scale and recommends the steps for correction.

3. Embrittlement

Tough steel fails like brittle glass when improperly treated boiler water allows caustic embrittlement to start. No sabotage could be worse than this.

4. Carry over

Boiler water belongs in the boiler. When boiler water carries over with the steam, superheaters frequently plug up and the boiler goes down for repairs.

steam production are tough!

lick them . . . just as hundreds of other war industries have, if you take the right step . . . and in time!

LIKE the germs in the human body which are always ready to start their deadly work at the first sign of physical weakness, Scale—Corrosion—Carryover and Embrittlement are ready to cripple your boiler system the moment you let up on your vigilance. You can't get away from their ever-present menace but you *can* protect your plant from them.

How? Through scientifically applied "preventive care" supplied by competent specialists whose life work and training is for the sole purpose of *keeping these boiler enemies under control.* There is no satisfactory substitute for such help. Its need began with the first pressure boiler. It became more acute as pressures increased. Today, it is a necessary requirement of the modern plant.

Hall research was founded to meet this need.

We met it by putting chemists and engineers on the problem who held to their research until they established the basic fundamentals of boiler water conditioning now universally accepted and employed. Your own operations are influenced by this work. Every modern power plant has profited through it.

Perhaps you already knew that. The story of Hall research and subsequent development is common knowledge among power plant technicians. But did you know that it is the very men who did that job who would supervise the servicing of your boilers—that they *are* the Hall operating staff and it is in their laboratories the field engineers are trained who would work on your problems?

Think of this difference. Investigate it. Weigh it against what you have seen of such services. We will be glad to put all the facts before you.

HALL LABORATORIES, INC.
HAGAN BUILDING · PITTSBURGH, PA.

HALL SYSTEM
of Boiler Water Conditioning

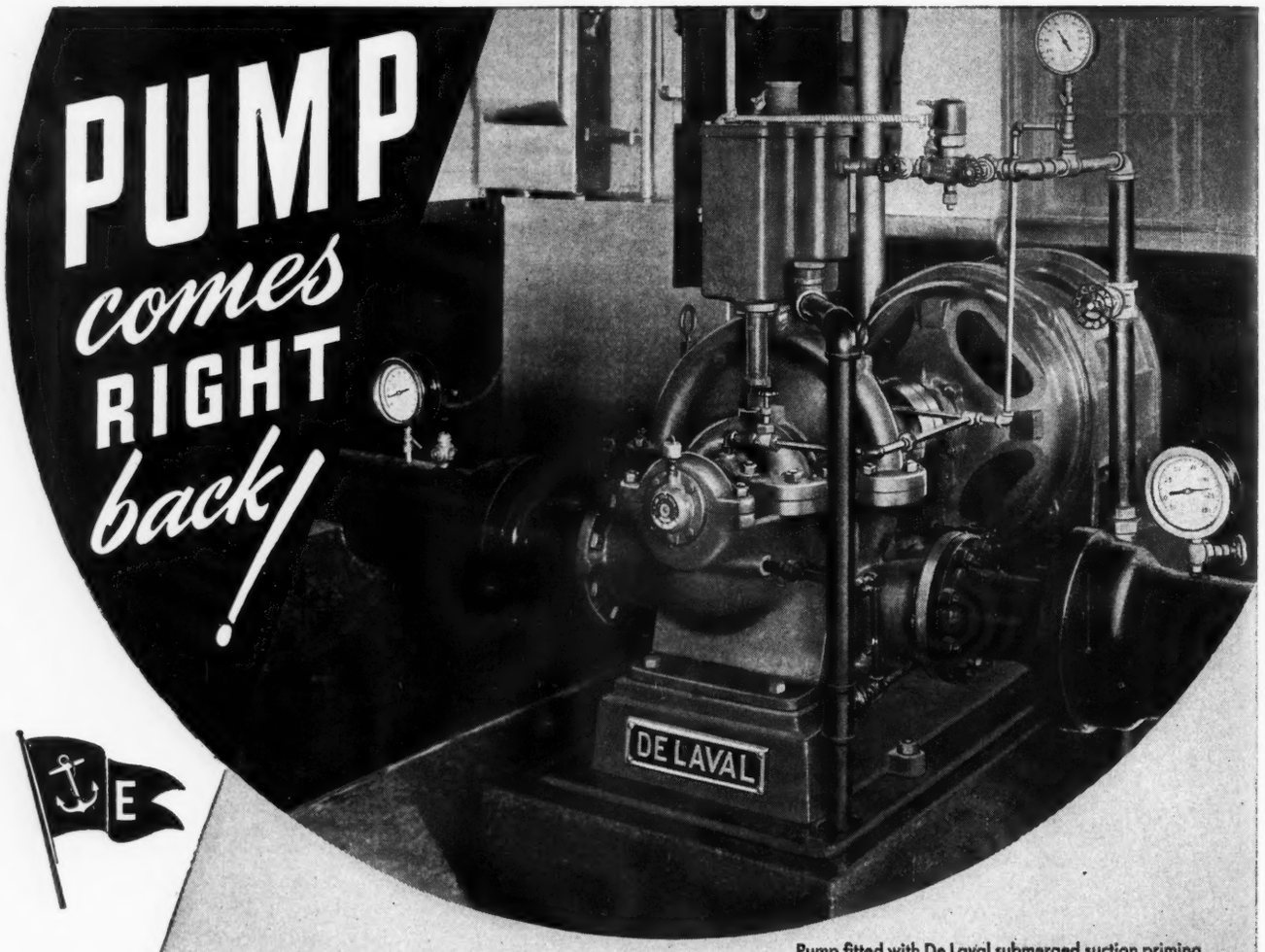
HALL SERVICE IN A NUTSHELL

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning.

In addition, with your full cooperation Hall Service:

1. Minimizes boiler outages caused by water.
2. Helps maintain highest efficiency.
3. Establishes non-embrittling water.
4. Minimizes carryover.
5. Prevents corrosion in boilers and associated equipment.
6. Prevents deposition in water lines and cooling systems.

PUMP *comes* RIGHT *back!*



Pump fitted with De Laval submerged suction priming system; 1100 g.p.m. against 245 ft. at 1750 r.p.m.

If the three-quarter-inch corporation cock on the suction pipe of the pump illustrated above is opened wide, delivery of water ceases, but is resumed again within one minute after the cock is closed, the pump being at once reprimed by the

DE LAVAL *SUBMERGED SUCTION* PRIMING SYSTEM

Were the air inleakage too great for the priming system to handle, the pump would automatically be shut down and could not be started again until the fault had been corrected.

With the De Laval Priming System the pump cannot be started unprimed.

Danger of surges or water-hammer reaching the pump casing is eliminated or minimized.

The pumping unit can be started or stopped at any time, from a remote control point if desired.

Proper adjustment of packing glands is simplified, as pressure is not admitted to the pump casing and suction line.

Ask for Publication P-3224.

HYDRAULIC INSTITUTE U.S.A. MEMBER

DE LAVAL *Steam Turbine Co.*

TRENTON, N.J.

MANUFACTURERS OF TURBINES . . STEAM, HYDRAULIC, PUMPS . . CENTRIFUGAL, PROPELLER, ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED-FLOW, CLOGLESS, SELF-PRIMING, CENTRIFUGAL BLOWERS and COMPRESSORS; GEARS . . WORM, HELICAL and FLEXIBLE COUPLINGS

VOLUME 86, No. 10

STEAM GENERATION
POWER GENERATION
DIESEL AND GAS ENGINES
PUMPS & COMPRESSORS
PIPING, VALVES & FITTINGS
AIR CONDITIONING, REFRIGERATION
ELECTRICITY AND CONTROLS
INSTRUMENTS AND CONTROL
STEAM SERVICES, HEATING
WATER TREATMENT
TRANSMISSION, LUBRICATION
OPERATION & MAINTENANCE
MISCELLANEOUS

POWER

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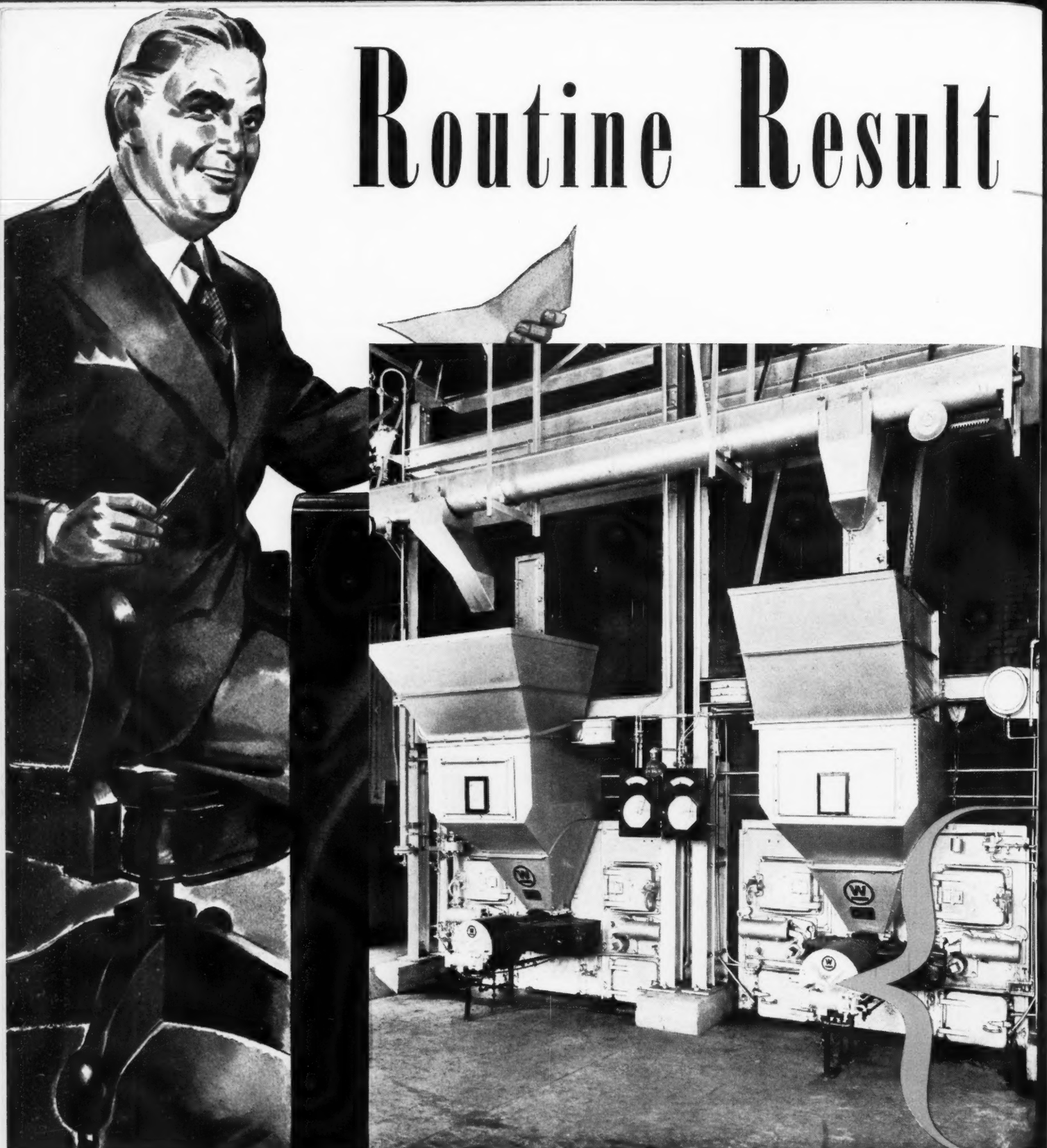
Routine Result



Complete three-and-one-half year service period at Louisville City Hospital required only $150 worth of replacement parts for these two stokers serving 276 HP and 295 HP boilers. Average fuel consumption: 6200 tons of East Kentucky coal per year. Stokers are operated in continuous service periods up to four months without shutdowns.

fuel savings paid for stokers in 2 years

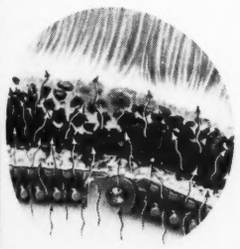
Louisville City Hospital, Louisville, Ky., reports cash savings in fuel costs alone over a two-year period were more than enough to write off the original investment in two single retort Link-Grate Stokers. This record isn't unique. Similar fuel savings have been experienced by Link-Grate users in more than forty different classifications, from hospitals to central stations, from small factories to largest process industries. How does the Link-Grate Stoker give these important savings?

Link-Grate Motion is the fuel saver! No matter what grade of bituminous coal is available, you can burn it effectively on a Link-Grate Stoker. Controlled, continuous motion of the grates processes the fuel bed, keeps it porous and reduces thin spots.

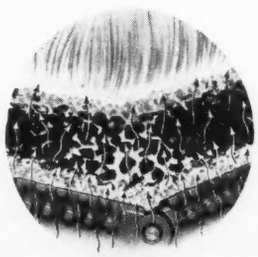
Air-Diffusing Design of grates assures thorough permeation of the fuel bed with low-pressure air for high combustion efficiency. Large volumes of air can be admitted to the fuel bed, but there is little tendency to blow through. At the same time, this continuous flow of air effectively cools the grates.

All of these factors add up to high daily fuel economy over the long pull. J-50417

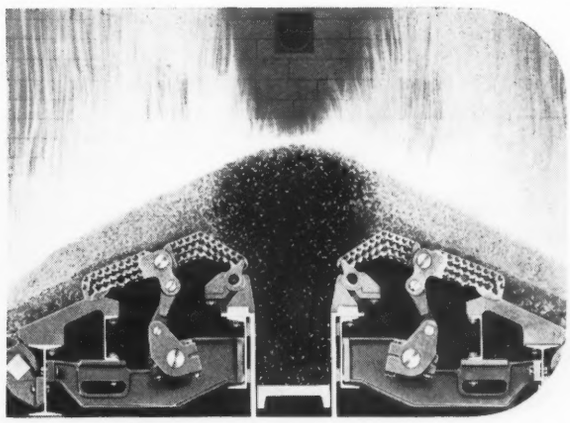
here's how the *Link-Grate* works



GRATES UP—Fuel bed broken, thoroughly permeated with low-pressure air. Fused ash oxidized, clinkers broken into small, friable pieces.



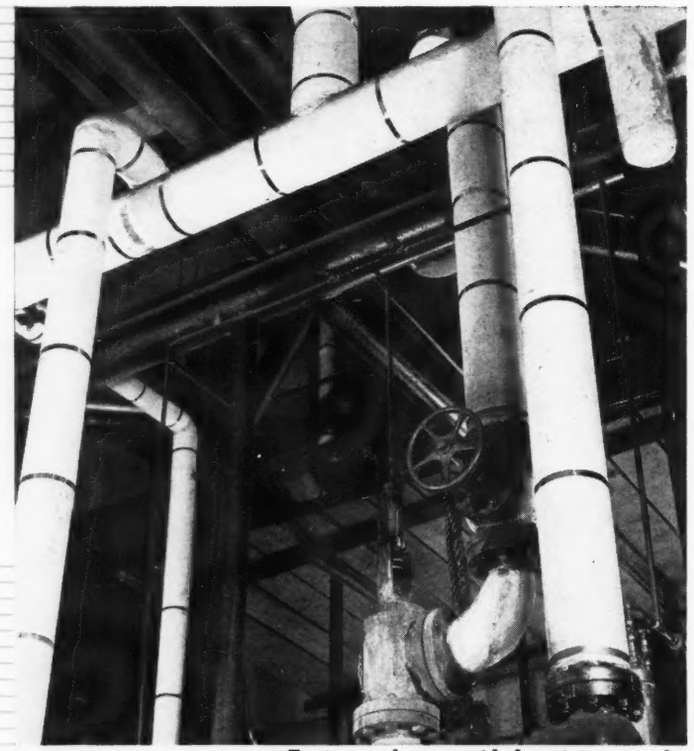
GRATES DOWN—Fuel bed made porous for uniform flow of gases throughout entire combustion zone —continuously conveyed towards the dump grates.



see Link-Grate Stokers in operation. Talk with operators and management. Get the performance facts, the economy figures. A Westinghouse representative will arrange a visit. In the meantime, send for these interesting Link-Grate factbooks: Bulletin 3039 (multiple retort), 2196-A (single retort). Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N.

Westinghouse

Have YOU any Piping Service with a "Chip on its Shoulder"?



Engineers here avoided maintenance by using wrought iron. Our piping bulletin will give you some interesting facts about pipe corrosion and its control.

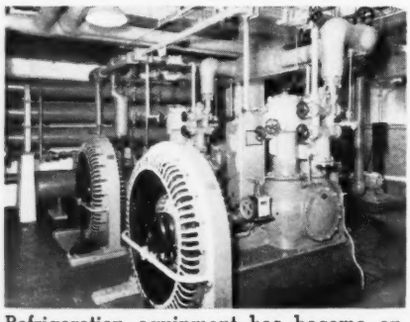
BYERS WROUGHT IRON

Almost every boiler room has piping services where corrosion or fatigue are trouble makers that shorten useful life, and yours is probably no exception. The experience of hundreds of engineers suggests a practical solution: genuine wrought iron.

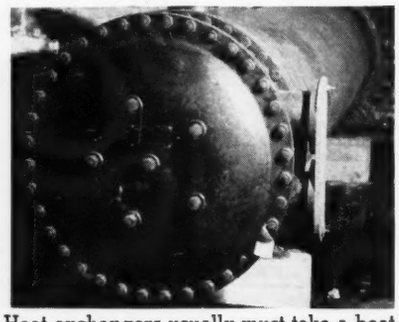
The illustration above shows some of the pipe in the enginehouse of a western railroad, where engineers made extensive use of wrought iron to avoid maintenance troubles. Wrought iron was installed in washout and refill mains, tempering water lines, exhaust leaders and lines, condensate lines, suction and discharge lines, steam lines to suction headers and suction leaders, water lines, overflow from washout tanks, and cold water discharge lines.

This varied application was based on actual knowledge of wrought iron's performance . . . and you can use the same sound test in selecting materials for your trouble-making services, whether piping or other applications like those shown below. All you need do is to give us details. From our "Experience Pool" we will select wrought iron performance records in similar or identical situations reported by engineers, and give you recommendations based on the findings. There is no cost or obligation, and we will welcome the opportunity of working with you.

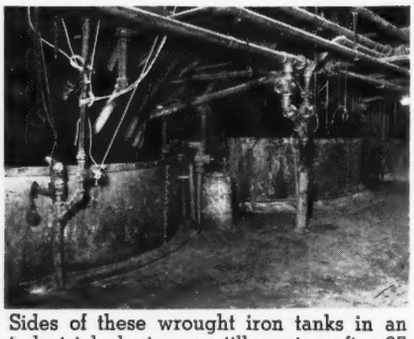
A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.



Refrigeration equipment has become an important industrial tool . . . and brought a string of new corrosion problems. Engineers in this utility installation solved them by using wrought iron in the "hot spots." Ask for refrigeration bulletin.



Heat exchangers usually must take a beating from corrosion. This one in the plant of a large New England manufacturer is protected with wrought iron tubes and tube sheets. Such use is standard practice with many experienced engineers.



Sides of these wrought iron tanks in an industrial plant were still serving after 65 years. Bottoms of two tanks were replaced after 39, and 44 years. Wrought iron is successfully handling dozens of process materials. Ask for tank bulletin.

Corrosion costs you more than Wrought Iron

BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

The Chemical Engineer cuts years to months...

Born in the turmoil of the last war, he is shaping a new world with mighty swords and magic plowshares

GERMAN CONSUL-GENERAL HOSSENFELDER, writing from New York on March 3rd, 1916, to von Bethmann-Hollweg, chancellor of the Imperial German Government, confidently predicted defeat for the United States because we were totally dependent upon the great chemical industry of Germany. "Americans," he wrote, "can never establish such an industry. They have the resources but they lack the necessary science and technology. And, besides, the conflicting selfishness of American business renders it impossible."

Even before the ink was dry on Hossenfelder's letter a new figure appeared on the industrial scene—the American chemical engineer. With the help of patient, but progressive and venturesome capital, he laid the foundations for the largest and most resourceful chemical industry in the world.

Today he is an all-important figure. For we are fighting a chemical war, even though the emphasis that is placed on planes, tanks, ships, guns and other armament tends to obscure that fact. And this chemical engineer is waging war for us on a prodigious scale. Bombers carry more tons of more deadly explosives because he has developed stronger and lighter alloys and more efficient fuels. Tanks are better armored and wield heavier blows because of products and processes born in chemical laboratories. Ships are welded together by new metallurgical techniques that save precious months over older processes. Gun barrels that are made in minutes instead of hours shoot farther and faster because of better ammunition.

And quantity keeps pace with quality. By mid-year of 1942, explosives were being produced in newly constructed plants twelve times faster than a year ago. Smokeless powder output has been doubled since December. Five times as much TNT was being made in July as in the months preceding Pearl Harbor. One single new plant produces more of this high explosive than did the entire pre-war industry—and several of these plants already are in production.

By what Major General William N. Porter, Chief of the Chemical Warfare Service, calls a "miracle of production," the sort of incendiary bombs that General Doolittle's lads showered on Tokyo were rolling out of our plants within a few weeks after we got into the war. As General Porter puts it, "they were rolling not by hundreds or even thousands, but by the millions." That record he has cited as a tribute to the "ingenuity, industriousness and patriotism" of the American chemical industries.

Yet the General agrees that we have only started to produce in the tremendous volumes that will shortly make Germany, Italy and Japan "revolve on their boasted Axis." Our newest plants are just coming into production. They face no limiting shortages of materials for, in the main, our chemical industry draws its strength from coal, salt, sulphur, limestone, oil, natural gas, coal-tar, air and water—all available in abundance.

We have heard little about the use of poison gas by our enemies. It may be that good reasons for this are stored away in our well-stocked chemical arsenals. American chemical manufacturers have worked hard and long with our armed forces so that if the time ever comes to make good on the President's warning of retaliation, America will be more than ready.

And defense against gas has not been overlooked. Every soldier is equipped with a most efficient type of gas mask, developed through twenty-five years of intensive research. The Chemical Warfare Service already is manufacturing millions of masks for distribution to civilians. Let us hope we may never have to use them. But if we must, we need have little fear of any gas or secret chemical.

This gas mask program has been made possible by a literal metamorphosis of production facilities, as peacetime industries have been converted to war purposes. A lumber company, for example, is making activated carbon from sawdust. Novelty manufacturers of rubber goods are turning out valves and assembling other parts. Former manufacturers of shirts, swim-suits, shoes and beds have converted their facilities and are contributing their share. More than eleven hundred contractors and two hundred and fifty sub-contractors are supplying their full quotas of chemical warfare materials. And production is right up to schedule.

But the bulk of the war job of our chemical industries has to do with items other than weapons and

ammunition. The German Consul-General, in that 1916 report to Berlin, said that many American industries were in a critical condition because of the scarcity of German chemicals. He related in particular that "the cries for help from the world of physicians are becoming louder and louder and more and more insistent." Thanks to our chemical industries this cry no longer is heard. Even though we are again cut off from quinine, camphor and some other strategic medicinals, our homes and hospitals are adequately supplied with synthetic products. Most of these are better and cheaper than the natural materials. The same sulfa drugs that have saved so many civilian lives in recent years have gone to war, with the result that deaths from infection at Pearl Harbor and Bataan are reported as surprisingly low. In this war we suffer no shortages of iodine and potash. Pioneering research in the field of vitamins has led to new industries that are contributing to health and better nutrition.

Those new uniforms the soldiers are wearing are of better quality and will last longer than the shoddy, ill-fitting outfits of 1918—thanks to sunfast dyes and new man-made products. And in the field of fabrics, nylon and the new rayons have gone to war in parachutes and super-strong cords for tank treads and tires.

* * * * *

And that brings up the question that 30,000,000 American motorists are asking with ever increasing concern. "When, Mr. Chemical Engineer, are you going to give us a set of new tires for the old family bus?"

That, I am told, is just what the chemical engineers have set about to do on a scale that is difficult to comprehend. In the words of Raymond Clapper, the columnist, "the synthetic rubber program for this year and the next is the biggest job of chemical engineering ever undertaken in the world." A billion dollar industry is being built at record speed to make almost a million tons a year of chemical rubber to serve our war needs and those of our allies. This cannot be accomplished overnight. Many months are required to design and fabricate complex equipment, much of which must be made from corrosion-resisting metals and alloys. We shall be lucky if a tenth of the desired capacity is in continuous production this year and even more lucky if, by the end of next year, the new industry should be turning out synthetic rubber at a rate of 875,000 tons—using both petroleum and grain as raw materials.

All this, of course, must go for essential military uses but there is reason to believe that in the laboratory and pilot-plant stages we have some promising substitutes and stop-gap materials that may tide us over until the big program starts rolling.

The present prospect of real success is possible only because of the cooperation of the chemical, rubber and petroleum industries. Individual firms and entire industries have set aside their normal desires and selfish interests to pool their patents, share their research and engineering developments for the common good. Synthetic rubber is here to stay as the basis for a great post-war industry: no doubt as to that lingers in the minds of the men who have seen many other natural products—indigo, alizarine, camphor, vanillin—all eventually fall before the ingenuity of the chemical industry.

* * * * *

In the coming peace to which we look forward hopefully, we shall find a new world full of new materials, new conveniences, new jobs, new opportunities, all stemming out of the present-day work of the chemical engineer. The same tough, transparent plastics that now make noses for bombers will give us new frameless windows for our homes and automobiles. With capacity to produce at least 2½ billion pounds of aluminum, which is five or six times pre-war production, and a magnesium capacity 50 or 60 times the pre-war figure, many new uses will develop for these structural materials of great strength and amazing lightness. Almost anything that flies, runs, moves, or otherwise is motive, will have a place for them. New fibers such as nylon and vinyon had scarcely got started before they were put to war use. Once the war is over they will be with us in greater abundance and at lower cost for a variety of uses so vast and so diverse that we can scarcely imagine them.

And the chemical engineer continues to create and to invent. He meets the challenge of scarcities and shortages with ever new "substitutes" that excel their originals. Even before the war is over he will have placed at our command a hundred new materials which we did not have before. His workshop is all industry. His contributions are as limitless as are our needs.

But right now his all-important job is to help win the war; to fight to a finish the ruthless and resourceful enemies that are devoting all their science and technology to bring about our defeat. So, as we take stock of our assets in this desperate struggle, we count among the first the proved resourcefulness of the research-minded chemical engineers we now have mobilized to help us fight this chemical war.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This is the fourth of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

POWER

Established 1882 • PHILIP W SWAIN, Editor

What to do about OIL

Last-minute conference with Office of Petroleum Coordinator reveals:

If this winter is cold and there isn't enough oil for all, "non-essential" plants will have to take the rap to protect war production.

Next year may be worse as U. S. delivers more oil overseas and to synthetic rubber plants here, while national gasoline rationing reduces production of residual oils.

Within 90 days OPC will survey every oil-burning plant in the country to determine where oil saving will justify tonnage of strategic metal required for conversion.

Experiments with colloidal fuel, 40% pulverized coal and 60% Bunker C, are being rushed.

Because modern war revolves around oil, many power engineers face a tough assignment—conversion to coal. Already the boiler-oil shortage has hit East Coast plants and threatens other parts of the country. Repeatedly warned, seaboard plants have converted to the tune of a 25-million-barrel annual cut in Bunker C consumption. And another 25 million barrels must be converted to coal in the near future. These big cuts will be essential to keeping up steam for war production this winter.

However, what oil does come to the Atlantic Coast won't travel in its customary style. Tankers that normally fuel the East have been driven from coastal runs by Axis submarines, or have been drafted to haul oil across the Atlantic and the Pacific. The remaining unconverted oil requirements of the seaboard will be handled largely by tank cars diverted from their normal service to consumers in the Mississippi valley. That's why the Midwest, too, must look to its oil deliveries.

Right now oil users in the affected areas are asking themselves three questions: 1—How long will this last?; 2—Should I convert?; 3—How?

As to the first, it's far from safe to assume the fuel situation will clear up after this winter. Quite the contrary! For us, as for all the United Nations, this will become increasingly a "shooting war". That means tankering more and more oil across the seven seas. These growing shipments will necessarily tie up pipelines and tank cars as well as tankers. Seaboard consumers will have to get along with what can be spared.

"Should I convert?" is generally answered for one by some higher power—very likely by Governmental order. And many who "can't convert" will often be told to find a way or go without fuel.

Once the decision to convert has been made, the only remaining question is "how?" Of many available ways, none will seem wholly satisfactory right now. Many will turn to the least costly practicable coal installation. Others will demand something better to keep down waste during several years of potential oil shortage and avoid coal-shoveling labor problems.

Whether the conversion is simple or ambitious, most engineers will have to do the job with cast iron, brick, tile, cement and wood, because strategic materials are out where substitutes can be made to serve for the duration.

Because POWER exists to communicate ideas and experience for the common good of all power engineers, the editors have collected conversion experience (page 66). These examples, large and small, simple and elaborate, represent the ingenuity of power men and suggest what can be done in hundreds of other plants.

OIL TO COAL IN WARTIME

Not enough tankers, tank cars, barges or trucks to supply Atlantic Coast fuel needs spells forced change to coal for every utility and industrial power plant that can do so. Although changeover costs money, efficiency and capacity are often reduced, and temporary expedients involve added labor costs, these plants have found solutions to coal-handling and firing problems that can suggest helpful hints to others

EAST COAST SUPPLIES OF FUEL and heating oil are badly below normal because usual summer increase of oil storage against heavy demands of winter months has been impossible this year. Tank cars are bringing some 800,000 barrels a day into the oil-short area and pipelines are pouring more oil into the East than ever before. Barges, lake tankers and trucks are already moving emergency oil eastward and will be able to move more as winter approaches.

But the combined capacity of all transport leaves the East considerably short of requirements for the coming winter, even with a reduction of over 20,000,000 barrels effected by more than 800 users of heavy fuel, and many conversions of house-heating installations formerly using light heating oils. If another 15,000,000 barrels per year of heavy fuel oil can be saved by some part of 2000 other users (those for whom conversion is possible) from Jacksonville to Bangor, transport will just be able to meet war needs of ships, essential power installations and minimum health requirements of home heating. There will be little or no margin to spare.

About 135,000,000 barrels of heavy fuel oil are used annually by East Coast utilities, industries, apartment houses, hotels and other consumers. The 60,000 barrels per day already converted represents the continuous hauling capacity of 5500 tank cars.

Conversion Costs Money

Conversion from oil to coal represents a costly step for many plants. It means spending money for a temporary installation to utilize solid fuel that, in some cases at least, will cost more per Btu and burn at lower efficiency in boilers designed for oil firing. But the present problem is not one of economics or convenience, nor is the necessity born of government whim. Simple addition of oil requirements balanced against possible transport facilities leaves a deficit for which no answer but curtailment has been developed. This means all will suffer individually, and war production will suffer collectively, unless the fraction of total users that can possibly convert to coal or other fuel take necessary steps to do so. And the situation shows no signs of improvement for long months, even years, ahead. It is not too late to start. Because the shortage is one of transport rather than source of supply, similar conditions will shortly be apparent in other sections of the country that depend on rail or any other means of oil handling that can be diverted to the more critical Atlantic Coast. The extent and severity of such shortages can not yet be predicted with any degree of certainty, but dislocation is inevitable.

To indicate possible methods and procedures for installing stokers or hand firing, creating coal storage where none existed before, and adapting typical oil-fired units to solid fuel, several examples of conversions already under way or completed are shown here. Drawings and photographs illustrate significant and ingenious details.

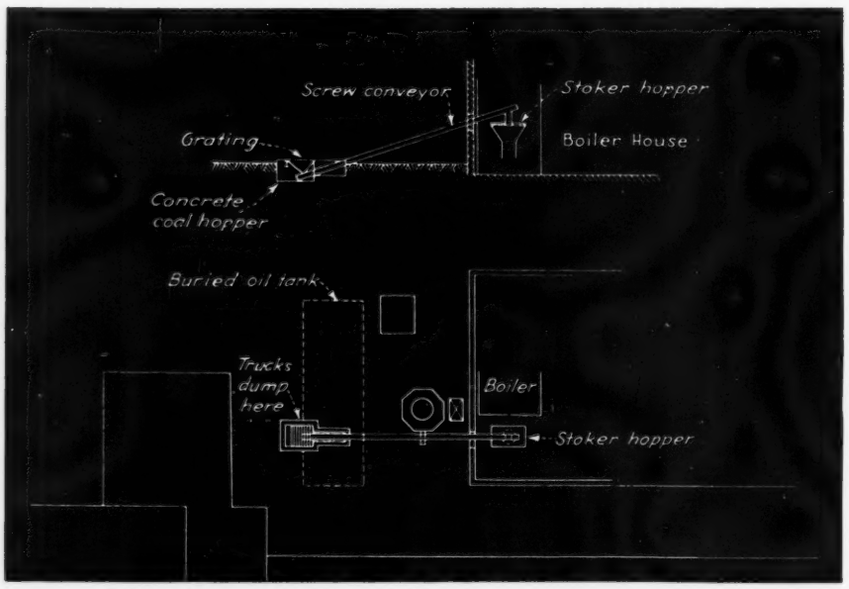


Fig. 1—Trucked coal dumped into yard pit over underground oil tank moves directly into stoker hopper by screw conveyor that pierces boiler house wall

Case Studies Show How

Typical of oil-burning plants without coal-handling facilities is the Lewandos French Dyeing and Cleaning Co of Watertown, Mass., oldest cleaning establishment in the country. Present boiler plant includes one 30,000-lb-per-hr Keeler boiler about two years old. and one 25,000-lb-per-hr Babcock & Wilcox unit about 15 years old, recently rebuilt. In addition to supplying steam at 185 psi, 450 F for power generation and process use, these boilers send a maximum of about 6000 lb per hr to a factory next door. Total summer

Fig. 2—Hand-operated grates at Liebmann are dumped in two sections per firing door (four per boiler). Grate surface for each of two boilers is 8x16 ft

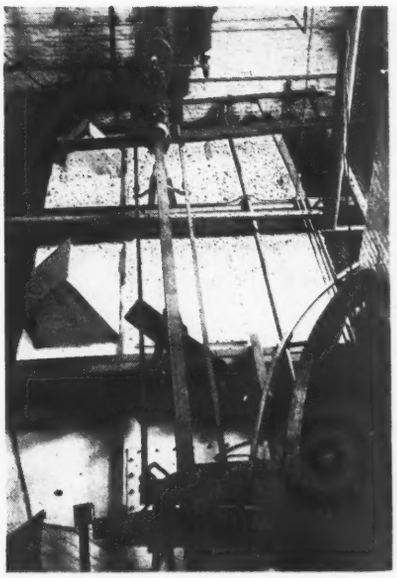


Fig. 3—Old bunker and monorail at Liebmann go back into daily service

load averaging 16,000 lb per hr and winter loads up to 22,000 lb per hr can be handled by either boiler.

Boilers stand side by side in a small building adjacent to the yard, Fig. 1. This yard, most convenient space for coal storage, already contains a small pile built up during the summer.

The Keeler boiler was selected for conversion because it stands nearest the yard and presents the simplest coal-handling problem. A small concrete pit has been built in the middle of the yard directly over the concrete-covered underground oil-storage tank. Trucked coal, dumped on the grating cover of this pit, falls on the foot of a screw conveyor, is carried up a slight incline into the boiler house and discharged into the stoker hopper. If necessary, stored coal can be shoveled by hand to the conveyor pit from the nearby pile.

Dust Problem

This coal-handling arrangement will be quite satisfactory from the standpoint of efficiency and convenience. The only serious drawback to coal firing is that dust from the storage pile and from handling operations may prove to be a serious nuisance in a laundry and dry-cleaning establishment. The job has been engineered on the basis of continuing indefinitely if necessary, but the primary purpose of the installation, of course, is to help out in the present fuel-oil emergency and provide the plant with "insurance" against shutdown.

While considerable expense has been involved, lack of steam for even a few days would cause losses far in excess of the cost of conversion. Additional operating costs, however, will include extra outlay for coal over oil at prevailing relative prices.

The Keeler boiler, a standardized 2-drum design with fully watercooled furnace suitable for either oil or coal firing, required some changes to convert to stoker operation. Fuel-oil pumps, originally in front of the boiler, were moved to one side to make room for the stoker hopper and the forced-draft fan. The original fan, air-supply duct and windbox were removed and stored for possible return to oil firing. Changes to the setting were minor and a small pit under the boiler provides for ash removal. Draft fan is turbine driven.

The change from oil to coal in this instance involves no loss in capacity and, because either boiler can carry a full load, permits normal operation on either fuel or any combination of the two. Except in the event of outage in the stoker-fired boiler, it is planned to operate entirely on coal, which will

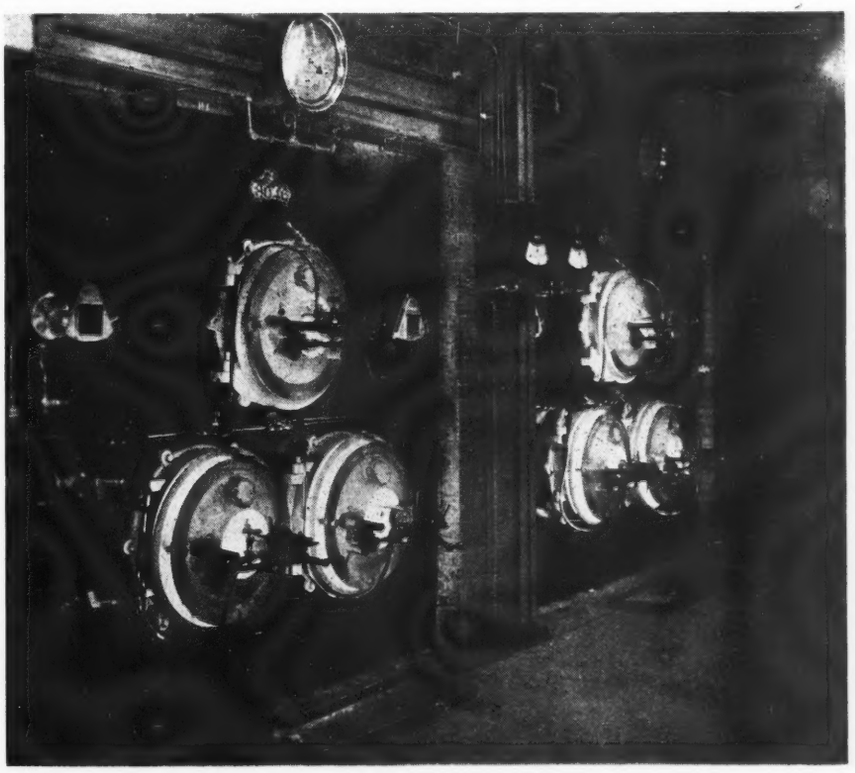


Fig. 4—Originally stoker fired, four 1904 boilers at Liebmann Brewery were changed to oil firing (above) in 1934; two now go back to dump grates for the duration

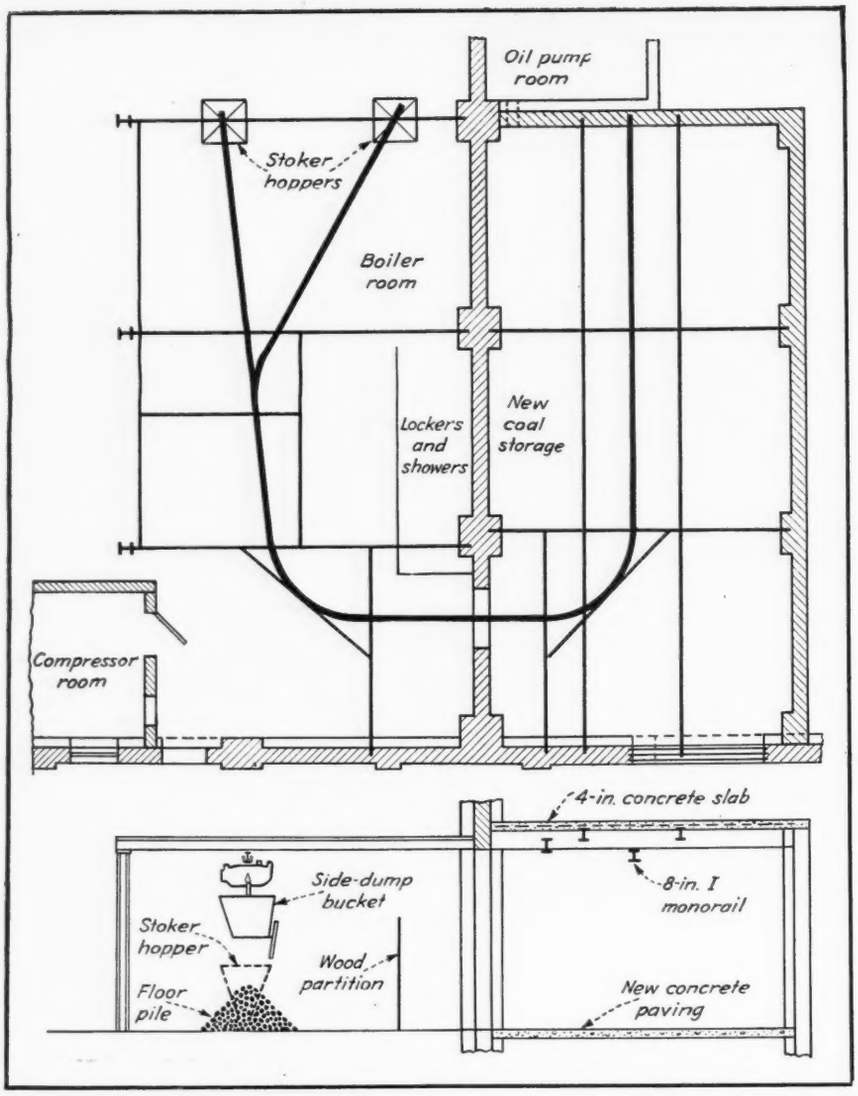


Fig. 5—Simple monorail transports fuel from coal pocket adjacent to the boiler room at the Jackson mill of Nashua Mfg Co. Car delivers to stoker hopper or floor

effect a saving of about 15,000 barrels of oil per year. Some oil storage will be maintained, however, so that the oil-fired boiler can take over in event of temporary trouble on the stoker unit.

Construction will be completed by the end of October under an A-9 priority on all materials except the stoker-drive turbine and forced-draft unit. The latter equipment required an A-1-j priority, which has been granted.

Engineering for the installation was carried out by Charles T Main, Inc, consulting engineers of Boston, and is under the general supervision of John H Harwood, president of Lewandos. The stoker is manufactured by Combustion Engineering Co and the conveyor by J C Corrigan Co. Over-all costs of conversion will be about $9500.

Typical of return to hand firing on a temporary basis for the "duration" of the oil shortage is a reconversion to dump grates under two 4400-sq-ft Stirling boilers at Liebmann Breweries in Brooklyn, N. Y., famous for Rheingold beer. These and two similar boilers were installed in 1904, fired by Murphy stokers burning double-screened soft coal. High labor costs were a factor in changing from coal to oil in 1934. The conversion reduced the boiler-room force from 18 to 4 men, and permitted scrapping six 1500-sq-ft hrt boilers on which the insurance inspectors had reduced permissible pressure.

Until the present conversion, the four boilers fired Bunker C oil, preheated to 180 F, delivered to three Todd mechanical-atomizing burners per boiler at a pressure ranging from 100 to 175 psi according to load. Two of the boilers, Fig. 6, will start operating on coal about October 1, by which time the coal-handling system should be ready. All possible load will then be carried on coal, the remaining oil-fired units standing by for peaks and emergencies.

Anthracite for No Smoke

Conversion was accomplished by new cast-iron boiler fronts and 8x16-ft hand dump grates suitable for buckwheat and pea anthracite which, it is expected, will avoid any trouble with the smoke inspector. A 225-ft brick chimney provides ample natural draft.

Coal bunker and monorail remain from earlier coal-burning days but a new bucket elevator is being installed, as shown in Fig. 8. Coal burning will not show a dollar saving, because of the extra labor requirements at relatively high wage rates. It will be necessary to add one man per shift plus an extra day man to trim coal in the bunker. The conversion was planned and executed by H Reese, plant engineer for Liebmann.

Of three separate plants owned by the Nashua Mfg Co, the Suffolk mill at Lowell, Mass., presents an interesting example of conversion to stoker firing because of a tie-in with the New

Fig. 6—Firing doors and hand shakers for dump grates at Liebmann Brewery bring back memories of the coal shovel and pusher bar

England Power Association to furnish excess electric power to the utility system. This mill has been inoperative for some years and the power plant operated only to provide sufficient heat to keep the buildings from freezing. In addition, for a period last winter, the plant contributed about 1500 kw to the utility system which was credited against power supplied to the other two operating mills at Nashua, N. H.

The boiler plant at Suffolk originally included eight boilers. It now has two 5080-sq-ft Babcock & Wilcox units. A year ago, in anticipation of a possible fuel-oil shortage, conversion equipment, consisting of a Westinghouse single-retort underfeed stoker and auxiliaries, was purchased, of sufficient capacity to operate one boiler at 225% rating.

Former mechanical burners for Bunker C have already been removed and the stoker is ready for heating-season service. It is likely that some power will be generated for the utility company, as it was last year. If utility demand is again about the same as last year, the single converted boiler will have ample capacity to carry the load on coal.

Temporary Expedient

Reasoning that this installation was primarily undertaken as a temporary expedient, the consulting engineers recommended minimum expenditure for equipment even though it meant increased labor requirements. Ample space in the boiler room, made by removal of the former boilers some years ago, permits a simple storage and handling arrangement. Coal is trucked to the plant and dumped on the boiler-room floor. No storage is provided beyond a 3-day supply as dependence is placed on regular deliveries. Operators wheel coal to the stoker hopper and rake out ash for hand disposal.

Some changes were required in the boiler setting, but on the whole, this installation represents a maximum of simplicity. Assuming that all steam is turned out by the stoker-fired boiler, approximately 15,700 barrels of oil will be saved during the winter by the consumption of 3650 tons of coal.

A Different Problem

At the Jackson mill of the same company in Nashua, the boiler plant supplies heating steam with a small amount additional for process. Four 1500-sq-ft and two 2500-sq-ft Manning vertical boilers were fired by steam-atomizing burners.

This plant has been completely converted to coal firing by the installation of hand-fired flat grates in the four small boilers and National single-retort stokers in the two large units. Only minor setting changes were required for conversion to coal firing.

As can be seen from Fig. 5, space adjacent to the boiler house has been converted into a coal pocket on the same level as the boiler-room floor. Plans call for the installation of a monorail to transport coal from the pocket to the boiler room. The monorail supplies stoker hoppers directly and piles coal on the floor for the hand-fired boilers. While waiting for delivery of the monorail equipment, operators wheel coal from the pocket to the hoppers.

Location of the coal pocket outside the boiler room is intended to keep the present boiler house intact for a return to oil firing. Main storage pile is outdoors, about 250 yards from the boiler house. Coal reaches this storage by rail and is handled between storage and pocket by small 4-ton trucks. Hired vehicles are being used temporarily, pending efforts to secure trucks.

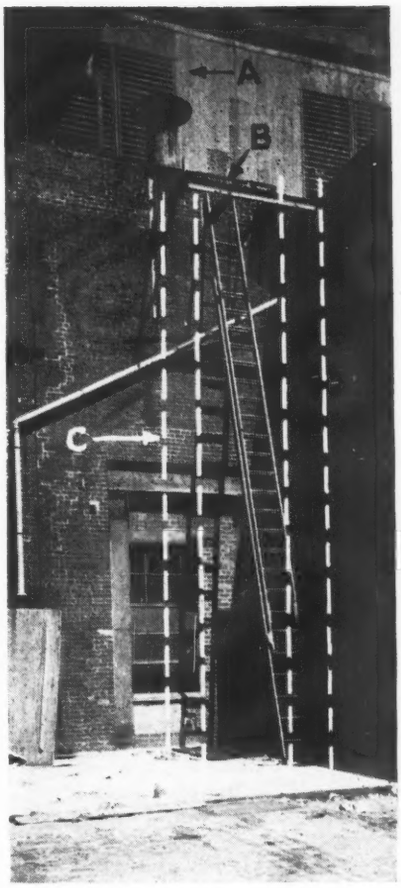


Fig. 8—Steel top frame *B* will support coal elevator within dotted lines *C*, to supply bunker back of wall at *A* in Liebmann Brewery conversion

Conversion to coal represents a substantial increase in labor costs at this mill since two men and a truck driver are required for moving coal from the main storage to the boiler house and one extra fireman is needed on each shift. This is an entirely temporary installation and it is planned to return to oil firing as soon as possible. The complete conversion represents a saving of about 20,250 barrels of oil a year, burning 4700 tons of coal.

The Nashua mill, major plant of the same company, presented a more complex coal-storage problem. Four 6030-sq-ft boilers set in batteries of two and two single set 5080-sq-ft Babcock & Wilcox boilers are installed, of which the two smaller units will be converted to coal firing by two single-retort Westinghouse stokers purchased before the present emergency, Fig. 7.

These units will operate at about 175% rating but will have stoker capacity to reach 225%. The plant was originally designed for coal firing but

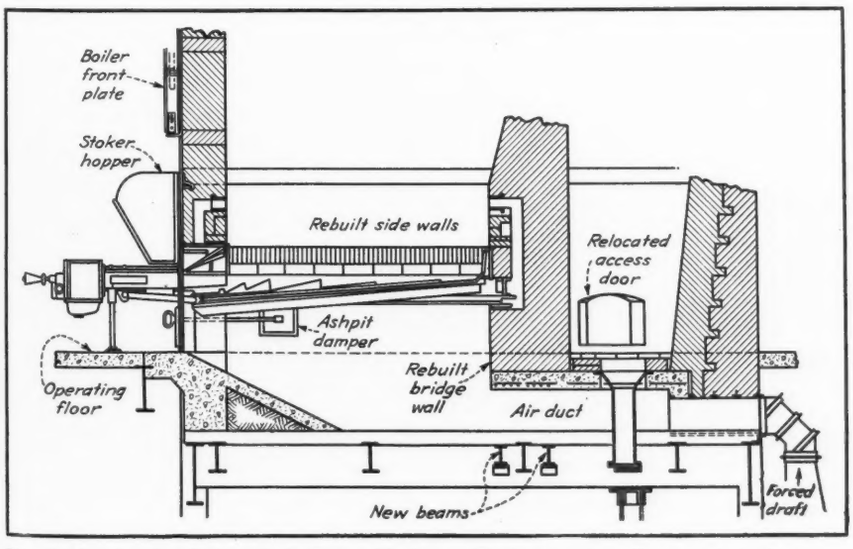


Fig. 7—Setting for 5080-sq-ft boiler at Nashua mill showing installation of single-retort underfeed stoker to replace forced draft mechanical oil burners

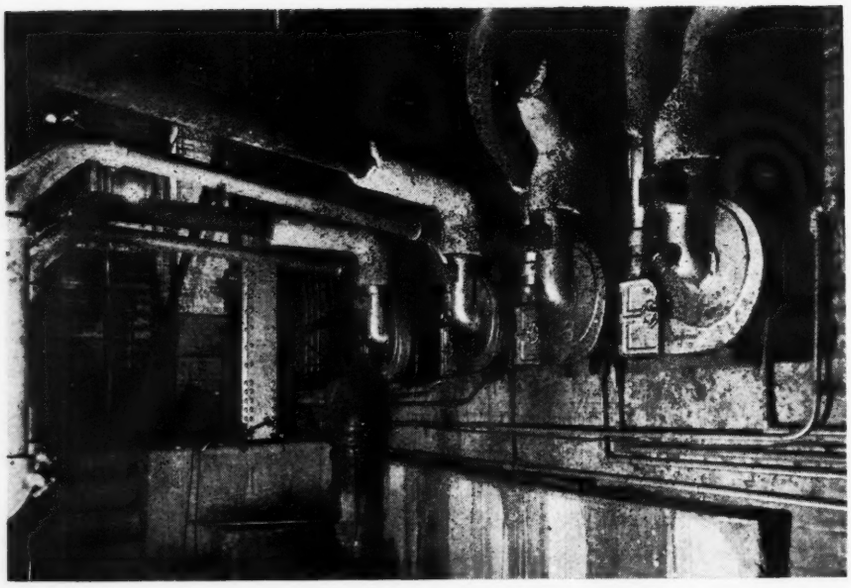


Fig. 9—Four transfer fans serve two boilers at Krueger Brewery. Fan supply is cold air tempered with hot gas led back from furnace through partially covered pipes

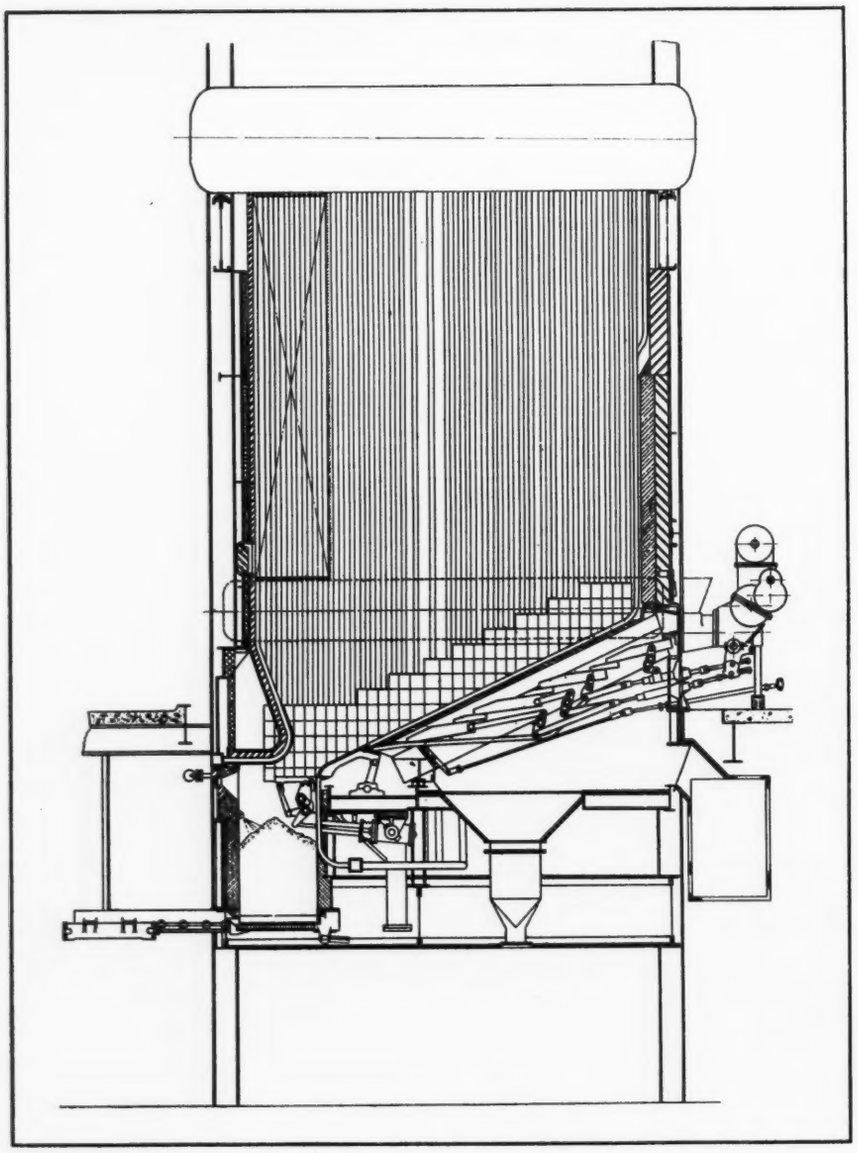


Fig. 10—New steam-generating unit for war plant will normally fire coal on water-cooled stoker, but can fire oil without any changes to setting

has been burning oil for about ten years. The old coal pocket adjacent to the plant is now partly taken up by oil tanks and no space for coal storage is available in the mill yard. Main storage pile of about 20,000 tons is therefore located about two miles from the boiler plant at the end of a semi-abandoned railroad track and will cover an area of about 200x500 ft.

As can be seen from Fig. 11, the railroad track runs along one side of the space in which five car-unloading pits are spaced at 800-ft intervals. Snatch blocks shift cars along this track. A car unloader, now on order, will work into the pit as shown, discharging into a self-propelled portable scraper conveyor. A small secondhand portable conveyor, pending delivery of the larger equipment, now works directly into the unloading pit. A secondhand gasoline-powered bulldozer transfers the coal to the pile and compacts the storage to prevent heating. Because of the large space available, coal will be piled only about 8 ft high and no trouble from heating is expected.

Plug-In Motor Drive

Unloaders and conveyors are driven by electric motors served from plug-in receptacles mounted on poles set about 100 ft apart over the storage area. Each piece of apparatus has 100 ft of cable any part of the area.

The portable conveyor will reclaim coal from the pile and load trucks for delivery to the mill. A used 8-ton truck will transfer coal. At the mill the truck discharges from a track built over the crusher in the old coal pocket, using the same access facilities as oil trucks. Coal moves from the old pocket into the plant over existing conveying equipment which was reconditioned.

The 20,000-ton main storage pile represents a substantial investment and several steps will be taken to protect it. A nearby resident has been employed to watch the pile and a system of flood-lighting has been drawn up. A supplementary electric-eye alarm is also under consideration. Protection will be necessary because of the isolated location of the storage yard from which theft would be easy.

Future operation of this storage system will entail building up during summer months with only a small amount of coal diverted to the mill where about 500-ton storage is available. During the remainder of the year the principal operation will be that of moving coal from storage to mill for daily use.

On the basis of converting the two boilers, additional labor will include one truck driver and an average of

three coal-yard helpers plus one extra man per shift at the mill. The conversion represents a reduction in fuel-oil use of about 50,000 barrels of oil a year, about one third of the annual consumption of the Nashua mill. About 11,500 tons of coal will be required. If the plant were fully converted, about 31,500 tons of coal would be required and the labor force augmented by another truck and driver and one more man in the boiler plant on each shift.

Engineering for the three Nashua Mfg Co installations was carried out by John A Stevens, Inc, consulting engineers of Lowell, Mass.

Another large New England manufacturer, engaged principally in war work, anticipated difficulty in obtaining oil fuel after purchasing a new oil-fired boiler as part of a plant extension. In this area, price has heretofore favored oil firing over coal.

Before installation of the boiler, plans were reorganized to include coal firing as either principal or emergency fuel. The 150,000-lb-per-hr Foster Wheeler boiler, Fig. 10, has been equipped with a 13-retort 429-sq-ft water-cooled Taylor underfeed stoker which allowed a wide latitude in fuel selection. Oil-firing equipment, not shown on the drawing, will be retained, enabling the use of either coal or oil independently or both fuels simultaneously at will.

Instant Fuel Flexibility

Coal will, of course, be the principal fuel for the present, with oil firing possible for emergencies. In the future, however, should price conditions or temporary lack of solid fuel dictate oil firing, the burners can be operated without any changes in stoker equipment which is protected from overheating by the water-cooling tubes. In event of future oil firing, the stoker becomes standby for immediate changeover to solid fuel. In this instance, provision of coal-firing equipment at the time of installation of a new boiler will save 240,000 barrels of oil annually.

Faced with an alternative between hand firing and spreader stokers, Chief Engineer H F Holmquest has built his conversion job around the latter at the G Krueger Brewing Co in Newark, N. J. Added investment for the stoker installation is balanced against higher efficiency and lower labor costs than would be possible for hand firing. Plans have been made in such a manner that coal firing could become permanent if the fuel scarcity or price situation should warrant.

The original installation at Krueger consisted of two Erie City boilers of

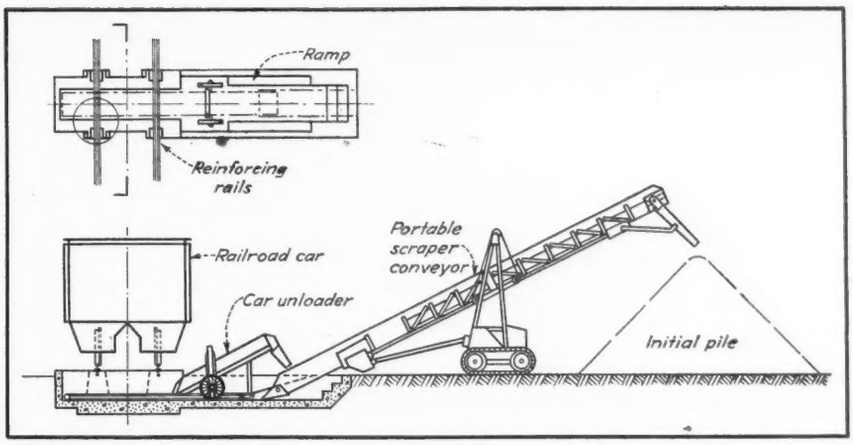


Fig. 11—Electric unloaders and portable conveyors elevate coal from five car pits at Nashua mill storage yard. Gasoline-powered bulldozer handles piling

6960 sq ft each, generating steam at 150 psi by firing Bunker C oil in three Lientz burners. One of these boilers was converted to coal late in 1941 and the other in March, 1942, both with Iron Fireman spreader stokers.

To gain room for ashpit and needed combustion space, the furnace floors were lowered 40 in. Boiler baffling was changed from horizontal to vertical, and bridge walls were built at the back of the grates. Coal moves from screw feeders to furnaces by air. Grates are stationary and cleaned by hand. To simplify operation, the ashpits are each split in two sections so that one side can be cleaned at a time.

Each furnace is served by two feeders and two blowers, Fig. 9. In addition, two forced-draft fans for each boiler supply under-grate air and two blowers return flyash to the furnace.

The plant formerly burned about 40,000 barrels of oil a year, all of which will be saved. Coal consumption this summer averaged about 30 tons per day. While sized coal would be preferred, that actually burned is the so-called "¾-in. resultant" which includes a range from ¾-in. down to slack, and firing is reported satisfactory. The only increase in labor over oil firing was the addition of two men per day to trim coal in the bunker.

The coal bunker itself is an old driveway that has been covered. Coal is dumped from trucks at the far end, brought up by belt conveyor and passed to a screw conveyor running the length of the bunker.

The foregoing case studies are actual histories of conversions made or in the making. No one pretends that they are an improvement in the art of power

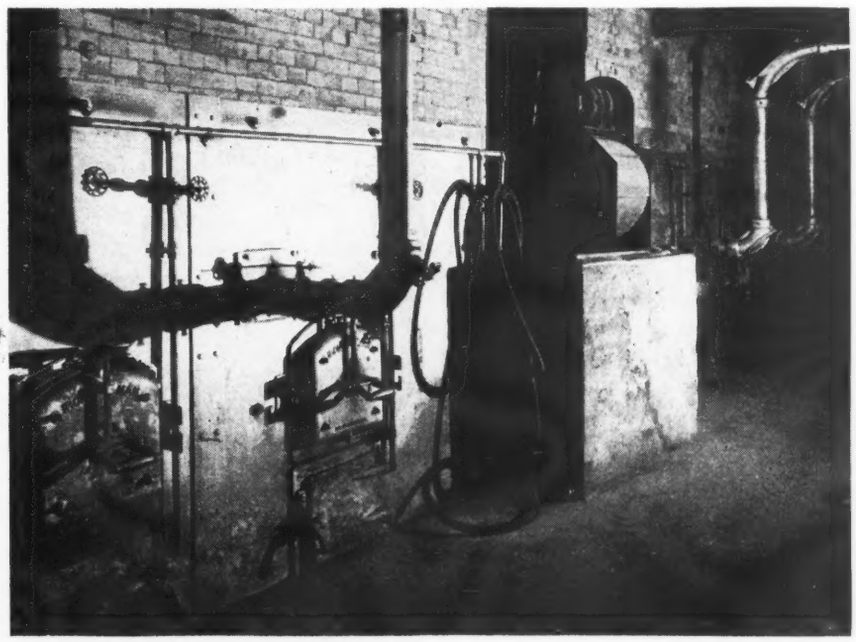


Fig. 12—Two pneumatic-stoker burners per boiler replace former oil-fired units at Krueger Brewery. Note forced-draft fan on concrete pedestal

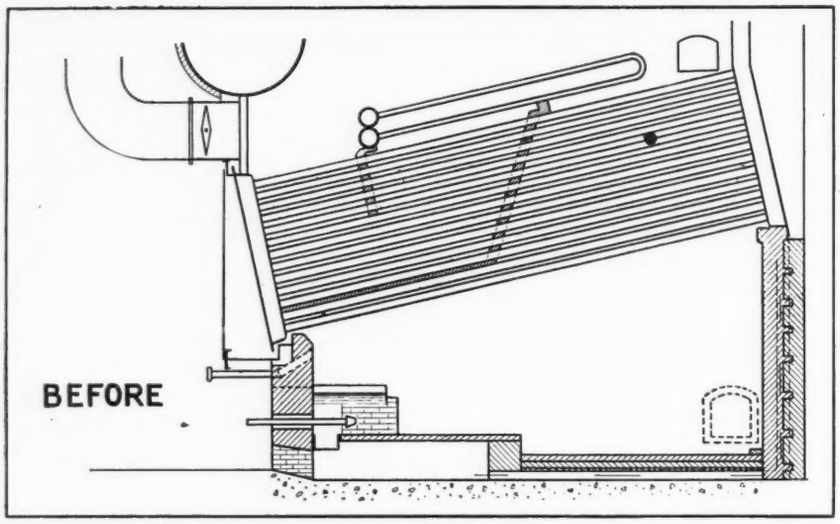


Fig. 13—Before conversion Krueger Brewery fired oil through a Lientz arch under this low-set straight-tube boiler. Note boiler baffling and floor construction

Plan for a coal supply as well as for equipment to make a conversion. Don't wait until stokers or grates are delivered to order coal; help the overworked railroads and assure availability of fuel when actually required by ordering in advance and building a stockpile. Careful storage (POWER, September, 1942, pg 88–91) prevents heating or deterioration of stored coal.

Fig. 14 (below)—Spreader stokers now fire Krueger units from high end requiring lowered floor, new baffling and installations of bridgewall. Note new ashpit construction and transfer fans across aisle from back end of boiler unit

and steam generation. Rather, they reflect the ingenious application of available materials and methods to the single objective of reducing industrial oil consumption quickly and effectively by the least costly available means and by taking advantage of any local conditions which make conversion simpler or results in use of less strategic material.

Indications point to a continuing fuel-oil shortage which may grow worse as the war enters the offensive phase and the strain on transportation facilities increases. Plants already converted have purchased insurance against the fuel uncertainties of the future; those still burning oil may have to work fast.

Every plant engineer now firing oil can find at least six good reasons why his plant cannot or should not be converted to coal. In the present situation such reasoning is wasted energy. The same engineer would find some temporary expedient in short order if he faced the certainty that the last oil shipment was already in his storage tanks. Now, before winter loads become realities and oil stocks dwindle, is the time for planning and for action.

If your plant is not yet converted, prepare plans now and keep them ready for instant action. Make application for priorities even though equipment may not be immediately available. These are time-consuming operations which can be gotten out of the way with only a small expenditure. If supplies exceed estimates this winter, cost of plans can be charged off to insurance. If fuel oil is shut off entirely from non-essential industries, as may well be the case, conversion can be accomplished more quickly if the paper work is already done.

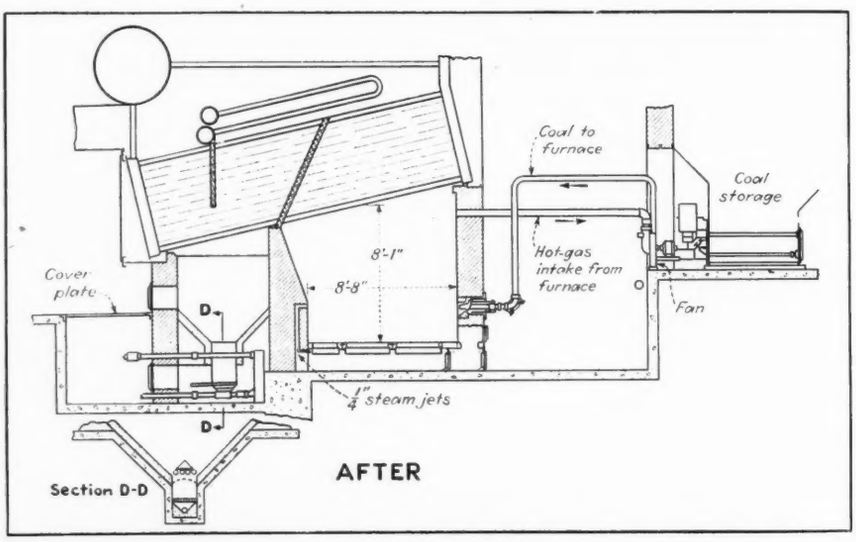


Fig. 15—Ash-removal construction at Krueger in former firing aisle

ARC-WELDERS' CHECK CHART

R F WYER
General Electric Co

TROUBLE	POSSIBLE CAUSES	WHAT TO DO
MACHINE FAILS TO HOLD HEAT	Rough, dirty commutator	True or clean commutator
	Brushes worn down to adjustment limit or life	Replace or readjust brushes
	Brush springs broken or have lost adjustment	Replace or readjust brush springs
	Field circuit may have variable resistance connection or intermittent open circuit	Check field current to discover varying current. Applies to both main generator and exciter if used
	Poor electrode lead or work lead connections	Tighten all connections
	Wrong grade of brushes installed on generators	Check with manufacturer's recommendations
	Field rheostat or tap switches making poor contact and overheating	Inspect rheostat; clean and adjust finger tension on switches
	Brush-shifting or other current-adjusting mechanism may have loose or worn links	Check current-adjusting mechanism for backlash and play
MOTOR TRIPS OFF LINE	Power circuit single-phased	Check for one blown fuse or dead line
	Welder operating above capacity	Check load against nameplate. Check duty cycle.
	Welding electrode or work leads too long or too small in cross section	Check terminal voltage with machine loaded; should not exceed 30 volts on small machines or 40 volts on large machines operating at rated current
	Ambient temperature too high	Make sure temperature in motor-generator room or housing does not exceed 100 F and that there is normal machine ventilation
MACHINE FAILS TO START	Power circuit completely dead	Look for open disconnect switch, fuses removed from clips, or blown fuses
	Power circuit single-phased	Look for one blown fuse or one dead line
	Power line voltage unsuitable for motor, or extremely low; may be accompanied by chattering of the motor starter	Check voltage particularly at the moment of attempted starting
	Machine jammed	See that armature turns over easily by hand; look for foreign material in air gaps
	Motor starter single-phased	See that all fingers on starter make contact when closed
	Overload protecting relays tripped	See that relay contacts are closed and that starter picks up when push-button is pressed. Be sure to remove cause of tripping.
WELDER STARTS BUT FAILS TO GENERATE	May be running the wrong way	Check direction of rotation with manufacturer's instructions or direction arrow
	Generator or exciter brushes loose or missing	Be sure all brushes bear on commutator and have proper tension
	Exciter not operating	Check exciter output voltage with voltmeter or lamp
	Field circuit of generator or exciter open	Check for open circuits in rheostat, field leads, and field coils. Also check resistors and rectifiers, if any
	Generator reversed in polarity or incorrect operation in parallel with another machine	Flash the field with a storage battery or another generator first with one polarity and then with the other to see if it builds up. (Flash exciter field if set has separate exciter)
	Series field and armature circuit open circuited	Check circuit with ringer or voltmeter
WELDING ARC IS LOUD AND SPATTERS EXCESSIVELY	Current setting too high	Check setting and current output with ammeter. Check polarity
	Polarity may be wrong	Reverse polarity or try an electrode of the opposite polarity

Experience Guides Design of

Valuable operating information obtained from first 1200-psi installation enables one large utility to iron out kinks in repeat order for another plant

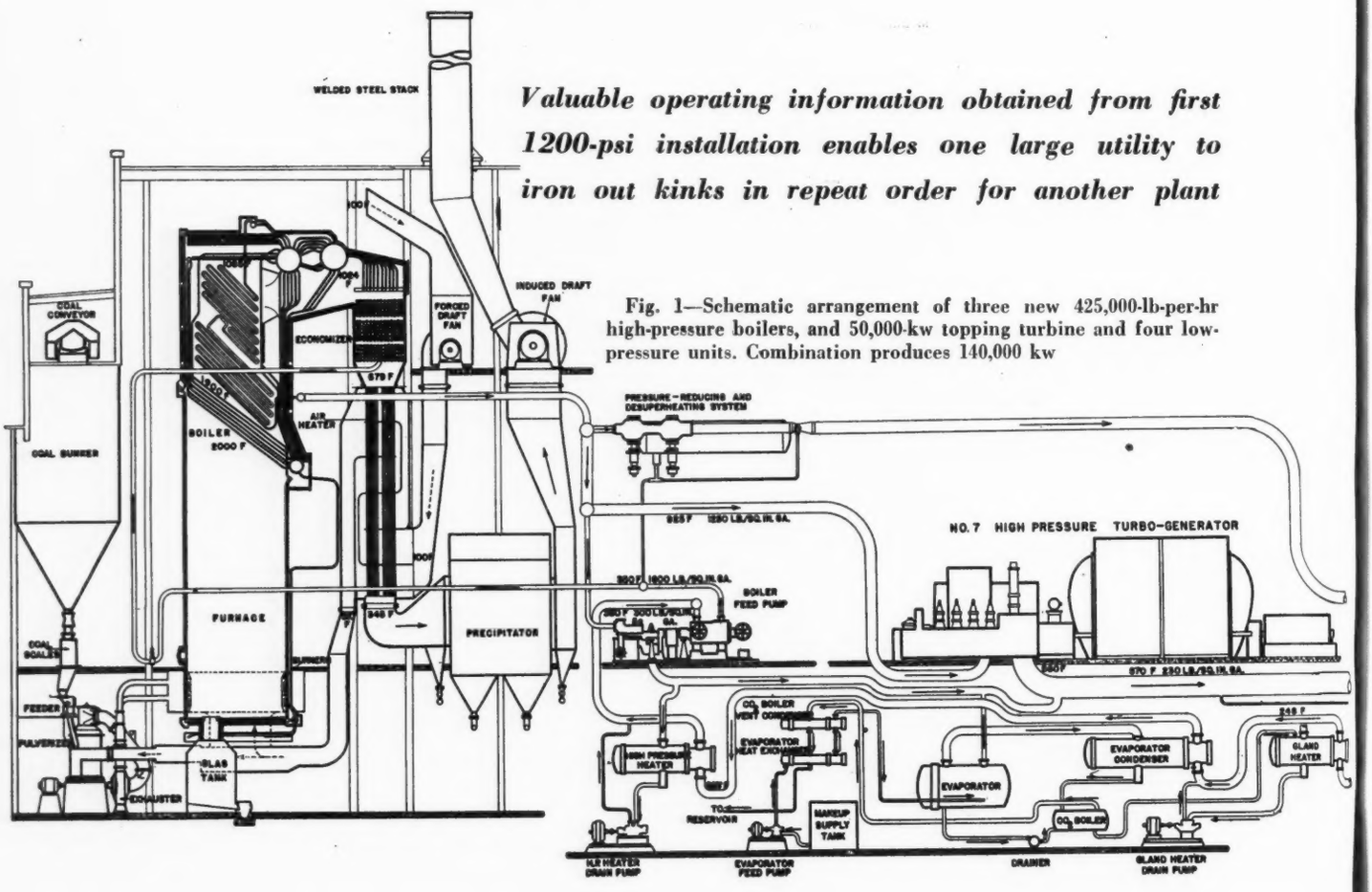


Fig. 1—Schematic arrangement of three new 425,000-lb-per-hr high-pressure boilers, and 50,000-kw topping turbine and four low-pressure units. Combination produces 140,000 kw

▶A SECOND NEW UNIT in the modernization and expansion program of a large utility system has now been in operation for about six months. This system's first topping unit in another station was started in 1937.

Three new 1325-psi boilers were put on the line in 1941, before the turbine was completed. They supplied steam to four existing condensing turbines through a pressure-reducing and desuperheating station long enough to afford preliminary experience with the operating characteristics of the steam-generating equipment. Some adjustments were necessary; these were completed before the turbine began operating in January, 1942.

This preliminary operation gave plant personnel an opportunity to put in actual practice the training received in an instruction program undertaken during the construction period.

The turbine and boilers have carried full load of 50,000 kw and, since January of this year, have been in regular service under normal loading.

The decision to superpose, rather than install new condensing equipment at this station, was influenced by limited supply of circulating water and the economic advantages of replacing old boilers. This station is the logical point in the system for maximum benefit from the added capacity and increased efficiency of generation.

Follows Earlier Design

Design of the plant addition was dictated somewhat by existing features of the station and influenced by valuable operating experience gained from the earlier installation at another plant of the same system. Plant conditions fixed the size of turbine, number of steam-generating units, steam conditions and general layout. Wide spacing of the boiler and superheater tube banks and liberal furnace proportions were provided to reduce slagging difficulties experienced with the earlier boilers.

As a result of adequate and effective boiler-water circulation and application of feedwater treatment by methods already proved in the earlier units, no tube failures have occurred. Major problems of slag fouling of boiler and superheater surfaces in the earlier units have dwindled to relatively minor concern in the new boiler even when firing coal of about 10,000 Btu per lb.

Each of the three new boilers can deliver 425,000 lb of steam per hr at 1325 psi and 935 F. The 1250-psi 925-F turbine is a combined impulse and reaction single-cylinder machine driving a 62,500-kva 0.8-pf 3600-rpm hydrogen-cooled generator. The turbine exhausts at 230 psi, 580 F to the low-pressure header system which can also be supplied by 15 remaining low-pressure boilers at full station load.

Normal operation of the topping unit will be in combination with any three of four horizontal low-pressure turbines, two of which are 25 cycle and two 60 cycle. While the aggregate capacity

Second Topping Unit

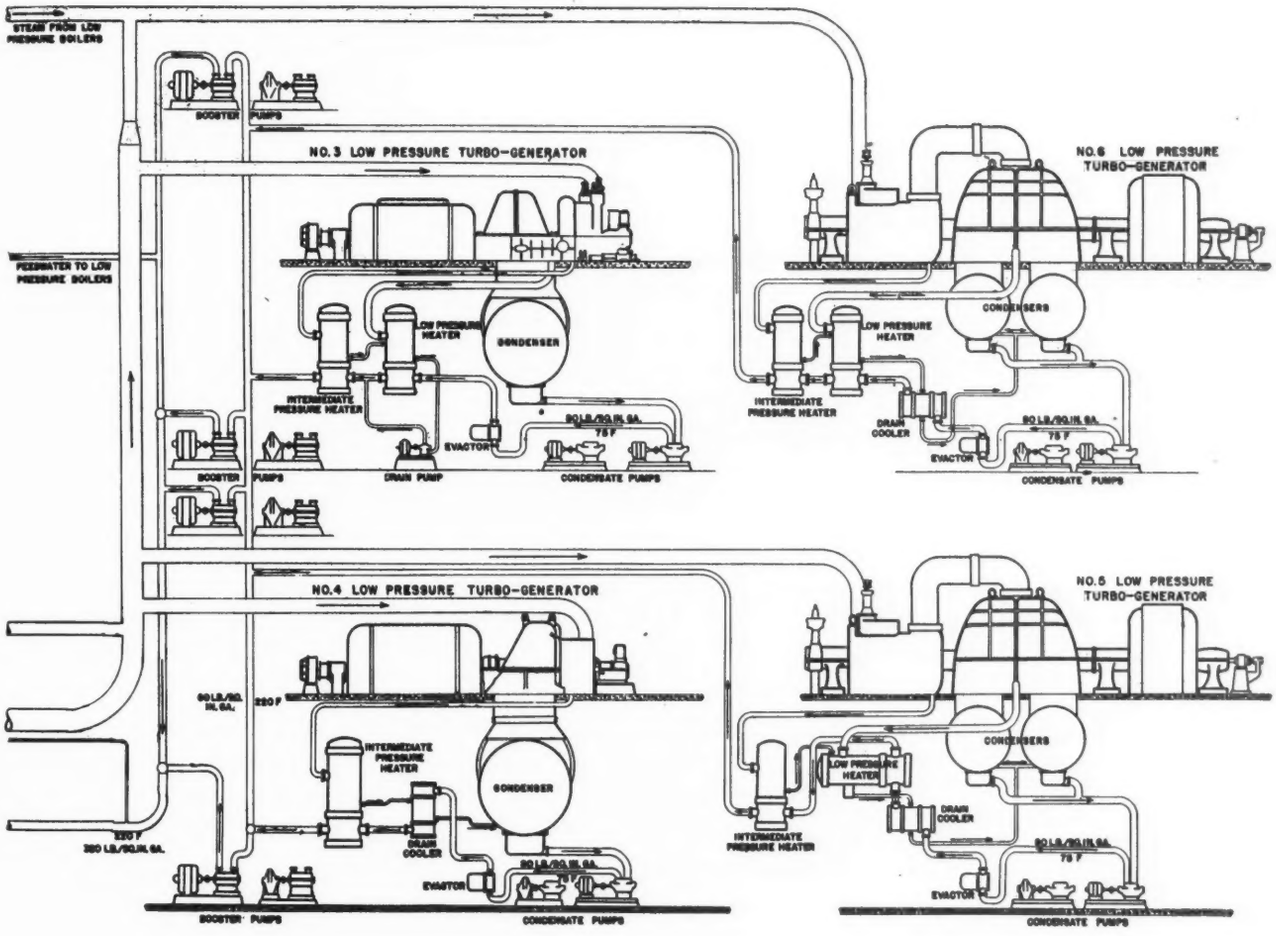


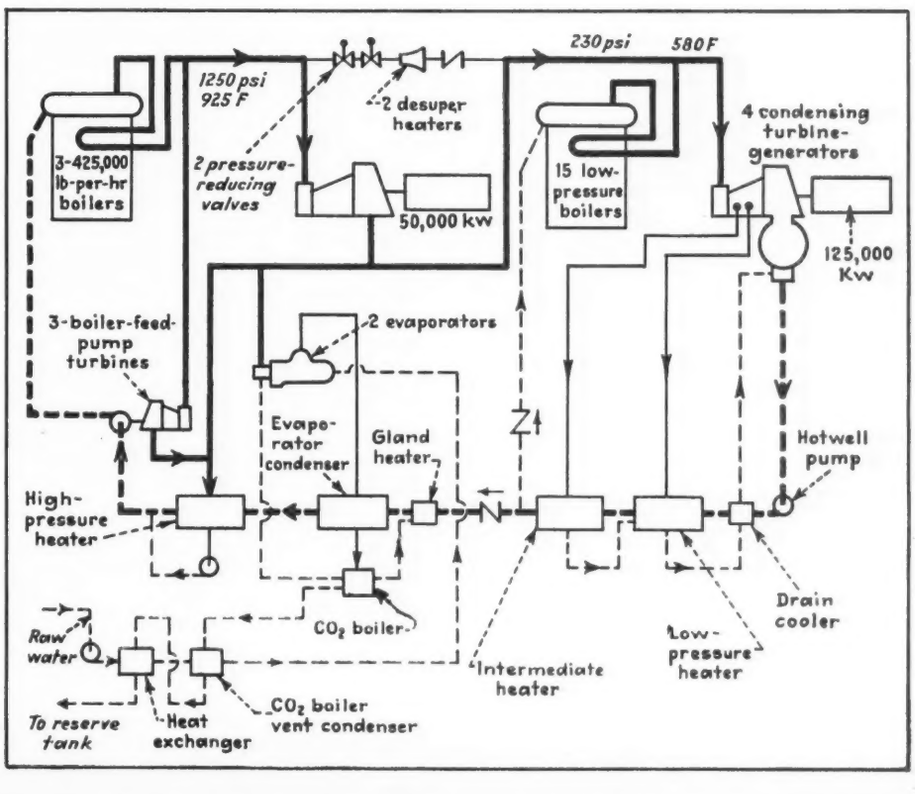
Fig. 2—Pressure-reducing and desuperheating steam provides for operation of low-pressure machines with steam from new boilers, an arrangement followed for several months before the turbine was started and available during machine outage

of these low-pressure machines is 125,000 kw, only about 90,000 kw can be served with exhaust steam so that the combined capacity of the superposed plant will be about 140,000 kw when the high-pressure turbine carries rated 50,000 kw with high-pressure steam.

At different periods of the day, load will vary on the 25- and 60-cycle machines with the demands of the separate systems. Thus the more-efficient high-pressure installation can contribute to either electrical system at different times of the day.

Accessibility

Like many other topping installations, existing building and general facilities have been utilized to the fullest extent. The piping is relatively simple and ample room, accessibility and ventilation have been provided. The boilers, with a steam-generating capacity equivalent to 140,000 kw, occupy the same space as those formerly supplying three low-pressure turbines with



a total capacity of 70,000 kw.
While the greater height of the new boilers required raising the roof, only minor changes were necessary in the turbine room.

All four low-pressure turbines already were operating on the regenerative cycle. Hotwell pumps take condensate through steam-jet evactor condensers, low-pressure and intermediate heaters to the suction of booster pumps not indicated in Fig. 2. These pumps discharge directly through the gland heater, evaporator condenser and high-pressure heater to the suction of the high-pressure boiler-feed pumps. Water temperature at economizer inlet is nominally 350 F.

Normal makeup is city water pumped through an evaporator heat exchanger and a CO_2 boiler-vent condenser before entering the evaporator. Evaporator steam comes from high-pressure turbine exhaust.

The station heat rate in previous years of normal low-pressure operation was about 23,000 Btu per net kwhr. With only the high-pressure unit in operation, performance is about 12,500 Btu net and at maximum station load with low-pressure boilers also in service, over-all heat rate will be about 14,000 Btu net. No normal performance records are yet available but indications are that expected economy is obtained.

The 3-drum boiler design is typical of the trend in modern high-pressure steam-generating units. Particular attention was given to prevention of slag fouling of boiler tube banks and superheater surfaces. In addition to mechanical flue-blowing installations on each unit, facilities have been provided for hand lancing all boiler and superheater surfaces. Very little hand lancing has been necessary to date.

No Tube Failures

In the boiler design, particular stress was placed on the solid-water downcomer supply and ample return circulating-tube area. These provisions for a single-circuit positive circulation have proved adequate, as no tube failures have occurred.

Coal for the high-pressure boilers is unloaded from barges or rail cars, crushed to 1¼-in. size and delivered to the bunkers by bucket conveyors and new belt conveyors. One 750-ton split-discharge bunker serves each boiler. The 350-ton-per-hr coal-conveying system transports a 24-hr supply in about five hours.

From the bunkers, coal passes through automatic coal scales to the feeders and mills. Two scales, two feeders, and two mills supply each boiler. After pulverization, coal conveyed by primary air passes through exhausters and is discharged into the furnace through two sets of tangential burners located one above another in the lower corners of the furnace. Each mill serves one set of four burners.

Ash content of the coal averages about 14%. Coal is pulverized to a fineness of 70% through 200 mesh.

Electrostatic Precipitators

Precipitators, one for each boiler, are located in the gas ducts at operating floor level between air-heater outlet and fan inlet. Flyash collected in the precipitator hoppers is removed periodically by a conveyor system which discharges into a storage tank. The tank, in turn, is emptied by a dustless unloader for disposal. Removal of flyash from all hoppers of one precipitator is made simultaneously. Air flow in the conveyor system is induced by a positive displacement mechanical exhauster with a standby steam jet for emergency.

Melted ash or slag flows continuously through a water-cooled slag opening in the furnace floor into a water-filled tank. It is periodically sluiced to an outside pit for disposal.

The combustion control system pro-

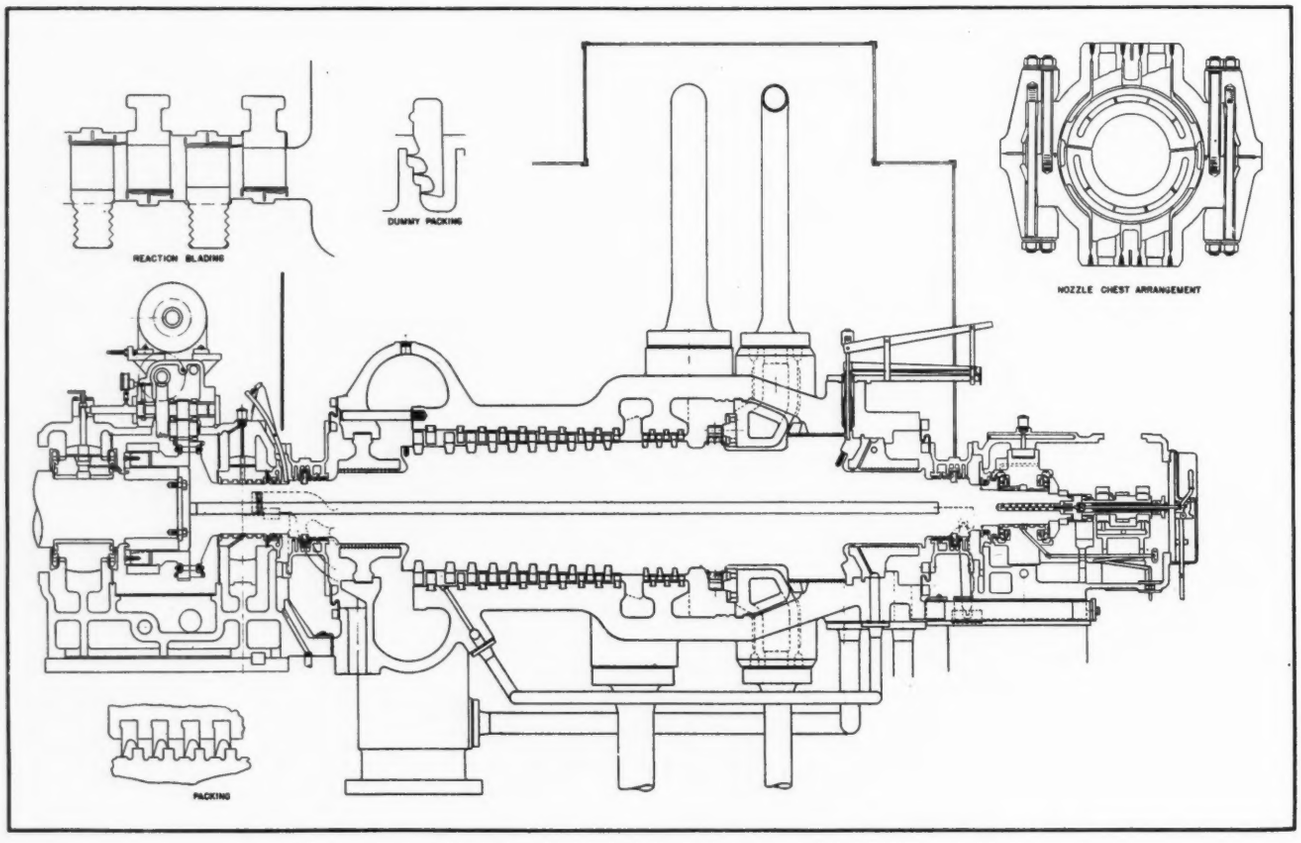


Fig. 3—The 1250-psi 50,000-kw turbine turns 3600 rpm. Either speed or back-pressure governing controls steam flow through two separate valve chests

Principal High-Pressure Equipment

Steam-Generating Equipment:

Boilers, 3, 425,000 lb per hr, 1325 psi; 935 F steam generators. Effective heating surfaces: boiler, 10,350 sq ft; furnace, 6815 sq ft; superheater, 22,884 sq ft; economizer, 12,262 sq ft; air heater, 62,725 sq ft; furnace volume, 24,250 cu ft. Max heat release 23,000 Btu per cu ft per hr. Pulverizers, 6, 17.5 tons per hr
Induced-draft fans, 3, 240,000 cfm Turbovane
Motors, 3, 600 hp, 720 rpm; 3, 1000 hp, 900 rpm
Forced-draft fans, 3, 145,000 cfm Turbovane
Motors, 3, 250 hp, 900 rpm; 3, 500 hp, 1200 rpm
Precipitators, 3, 75 kv. 36 gas duct
Transformers, 6, 25 kva, 208 v, 75 kv. Mechanical rectifiers, 6

Turbines and Accessories:

Turbine-generator, 50,000 kw. 3600 rpm. Turbine 1250 psi, 925 F throttle; 230 psi exhaust. Generator 12,600 v, 3-phase, 60 cycle, 0.8 pf hydrogen cooled
Boiler-feed pumps, 3 500,000 lb per hour, 1600 psi, 350 F
Boiler-feed-pump turbines, 3 1250 hp, 3560 rpm
Boiler-feed pump, 500,000 lb per hr, 1600 psi, 350 F
Boiler-feed-pump motor drive, 1500 hp, 3560 rpm, constant speed
Gland heater, 2230 sq ft, 2 pass
High-pressure heater, 1408 sq ft, 2 pass
Evaporator condenser, 3000 sq ft, 2 pass
Evaporators, 2, 25,000 lb per hr, 910 sq ft
CO_2 boiler, 101,600 lb per hr, 36 in. dia
CO_2 boiler vent condenser, 111 sq ft, 2 pass
Evaporator heat exchanger, 75.5 sq ft, single pass
Heater drain pumps, 2, 250 gpm, 345 psi
Gland-heater drain pumps, 2, 350 gpm, 345 psi
Evaporator feed pumps, 2, 150 gpm, 180 psi

Pressure-Reducing and Desuperheating Equipment:

Quick-opening valves, 2, 1500 psi, 10 in. Pressure-reducing valves, 2, 1500 psi, 10x16-in., 700,000 lb per hr. Venturi type desuperheaters, 2, 400 psi, 16x18-in. Water storage tanks, 2, 400 psi, 42 in. dia x 18 ft long

vides not only full automatic control but boiler manual control and hand operation.

Mercury manometers indicating individual mill loads are arranged to read in straight-line relation to boiler load instead of the usual square function. Fuel and air manometers, mounted beside each other, likewise show fuel-air ratio directly. Under manual control, the regulators of any boiler can be operated by a single hand element or each regulator controlled individually from the boiler board when desired, making for simplicity in starting-up operations.

A superheater bypass damper regulator for maintaining constant steam temperature has a remote hand control unit only. Fuel feed is controlled through regulators on the mill feeder and primary air is varied by regulators that actuate exhauster-inlet dampers.

Total air flow is controlled by regulators which position control vanes on the induced-draft fans. The furnace-draft regulator, responding only to draft and not to master loading pressure, positions vanes in the forced-draft fan suction. These regulators can also be controlled manually from the boiler boards.

Water-Level Control

Drum water level can be maintained automatically or regulated by hand from the boiler board. Efforts to obtain simplicity in the control system have resulted in designs that have proved to have many advantages over that used for the previous installation.

Normally three boiler-feed pumps operate when three boilers are in service. Of the four provided, three are turbine driven and one is motor driven. Turbine drives take from the high-pressure stream line and exhaust to the low-pressure header system in parallel with the topping unit. Turbine-driven pumps have a feedwater differential control system that maintains an equal or proportional flow of water through individual pumps and at the same time holds a pressure differential between steam and feedwater either constant or set to increase with rising boiler load. This control is accomplished by regulation of steam supply to the feed-pump turbines. The motor-driven pump is handled by throttling the pump discharge. All turbine-driven pumps can be hand controlled if desired by regulating their speed governors.

Two Steam Chests

The topping turbine is of Rateau-reaction type. Because of the large amount of steam to be introduced, the turbine has two steam chests, one on either side of the turbine cylinder. On each steam chest is mounted a 14-in. throttle valve and four admission valves. An equalizing pipe connects the steam chests at points directly after the throttle valves to equalize flow.

The machine has four valve points; corresponding valves in each chest control each. As indicated in Fig. 3, steam expands through one Rateau (single-impulse) and 13 reaction stages. The impulse blades are of extremely sturdy construction to withstand shock loading under partial steam admission. The unit has both speed and backpressure governing.

Pressure-reducing and desuperheating equipment permits continued operation of the low-pressure turbines with steam from the high-pressure boilers in event of outage or trip-out of the topping turbine. Two sets are required because of limits on practical valve size. Each set can pass 700,000 lb per hr and consists of a quick-opening and a regulating valve in series followed by a desuperheating venturi at the throat of which water is injected.

At a predetermined reduction of pressure in the low-pressure header, the reducing stations cut in automatically to supply the required amount of low-pressure steam. For periods when automatic control is not desired, remote hand control for positioning the regulating valves is provided.

Operating Experience

Few changes have been necessary from the original installation. Some corrective measures were required to secure the degree of superheat control necessary to satisfy the rigid specified requirements of the turbine manufacturer. It was found that minor changes were required in the superheater bypass damper to provide greater gas flow through the bypass at high loads. It was also noted that the slag covering sidewall tube surfaces dropped off when changing from higher to reduced boiler loads, causing greater heat absorption in the furnace and fluctuations in steam temperature. Application of slag hooks (tube studs) over part of the wall area helped retain a normal slag coating at all boiler loads with resultant more-uniform steam temperature.

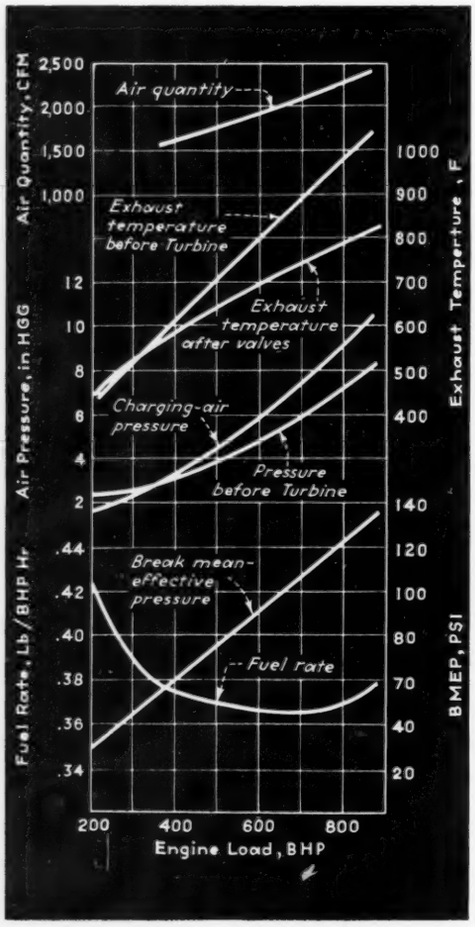
To secure desired superheat over a greater range of load, the top set of burners was replaced with burners of the tilting type. These are now manipulated to direct the flame upward when the boilers are operated at low load with the result that proportionately less heat is absorbed by the furnace and more by the superheater. Tilting burners will be applied to all boilers as conditions permit.

Turbochargers Increase Output of Existing Four-Cycle Diesels

J P Stewart, Elliott Co, shows how the Buchi supercharging system works and how turbocharging may be applied to existing engines for a 35-40% capacity increase at an approximate cost of $30-40 per added horsepower

▶ THE KEYNOTE of today's war-production requirements is more power from existing equipment. The use of the Buchi system of turbocharging offers one means of securing additional output from 4-cycle diesel engines. Numerous conventional engines have been turbocharged with relatively few internal design changes for substantial changes in output. Such applications were successful on existing engines in the field as well as on new engines. The practical increase in rating varies according to original design, unsupercharged rating and service conditions. As a general rule, power increase amounts to at least 35-40%, and more where engine design is particularly suited to turbocharging.

Fig. 1—Characteristic performance curves of typical turbocharged engine



The Buchi system can be applied to 4-cycle engines for virtually any service and with few limitations as to type, size, or speed if the engine is of more or less conventional design. Applications have been successful on both air- and solid-injection engines and on low-, medium- and high-speed units. In general, the open combustion chamber with central injection gives best results with turbocharging.

The turbocharger unit is entirely self-contained and connects to the engine only through exhaust-gas and air manifolds. It consists of a gas turbine, driven by exhaust from the power cylinders, and a centrifugal blower, mounted on a common shaft. The blower supplies all air required by the engine, under pressure, through the conventional air-intake manifold. The turbine utilizes part of the exhaust-gas energy which would be wasted.

Scavenges Residual Gas

The low-pressure air delivered by the turbocharger blows through the combustion space and valves, thus scavenging the residual gas left at the end of the exhaust stroke and replacing this gas with cooler fresh air. This produces a cooler air charge of greater density at the end of the suction stroke. This scavenging and pressure charging permits combustion of more fuel without harmful effects to the engine. This means a higher output compared to a normally aspirated engine of the same displacement.

The process employs a method of creating timed pressure pulsations in the exhaust manifolds. This is accomplished by the timing of inlet and exhaust valves and proper combinations and dimensions of exhaust manifolds and turbine nozzles. The valve timing of a Buchi turbocharged engine differs from that of the same engine normally aspirated, in that the exhaust valves close later and inlet valves open earlier, thus providing a greater period of overlap during which both inlet and exhaust valves of a particular cylinder remain open when the piston is near top center.

Operating Cycle

The initial high pressure of gas leaving each cylinder at the beginning of the exhaust stroke is effectively transformed into kinetic energy by the proper proportioning of exhaust manifolds and turbine nozzles. This energy drives the turbine. After the initial surge of exhaust gas from the cylinder, pressure in the manifold drops nearly to atmospheric, while blower air pressure remains considerably higher. The inlet valve then opens before the exhaust valve closes, permitting fresh compressed air to blow through, scavenging the clearance space, cooling the cylinder walls, pistons and valves, and mixing cool air with the hot exhaust gas in the manifold.

After the exhaust valve closes, the inlet valve remains open to about the beginning of the compression stroke, and the cylinder fills with relatively cool fresh air under pressure. To prevent interference between exhaust gas impulses, and to prevent blowing exhaust gas from other cylinders during the scavenging of a given cylinder, separate manifolds from groups of either two or three cylinders connect to separate banks of nozzles in the turbine.

Application of turbocharging to existing engines offers a substantial output gain with small weight increase and generally no additional useful space requirements. Sea-level rating can be restored to engines operating at altitudes of 12,000-14,000 ft, and on en-

gines operating at lower levels outputs in excess of unsupercharged sea-level rating can be obtained.

Turbocharging changes fuel consumption only slightly over the original unsupercharged output range. For the increased-output range, the curve stays flat and the fuel rate at the new turbocharged rating will be about the same or slightly less than at original unsupercharged rating.

No Controls Needed

Because turbocharger operation is fully automatic at all loads, no controls are required. Speed, air quantity, and charging pressure follow engine load and speed changes instantaneously because of the low inertia of the turbocharger rotor. The engine responds to load changes in the same manner as an unsupercharged engine. It starts easily and quickly under cold starting conditions and during the start-up the starting air accelerates the turbocharger until the engine fires.

The turbocharger connects to the engine only through the air and exhaust-gas manifolds; no belts, gears or chains are required. Because the turbocharger always operates in the same direction regardless of engine rotation, turbocharging suits direct-reversing marine applications. As the turbocharger rotates from one to two minutes after engine shutdown, it may rotate continuously during maneuvering.

Experience indicates that turbocharged engines rank equally with unsupercharged units in regard to reliability and present no additional operating difficulties or maintenance costs. Efficient scavenging tends to keep pistons, cylinder heads and particularly exhaust valves in better condition. In spite of increased output it is generally possible to limit maximum firing pressure to a nominal increase which has no harmful effect on engine parts. The pressure increase affects average bearing loadings only slightly; bearings designed for satisfactory unsupercharged operation prove equally reliable after turbocharging.

Temperature Limits

At reduced speeds, down to 50% or less, engine torque can be maintained constant—and in some cases actually increased—without exceeding established temperature limits.

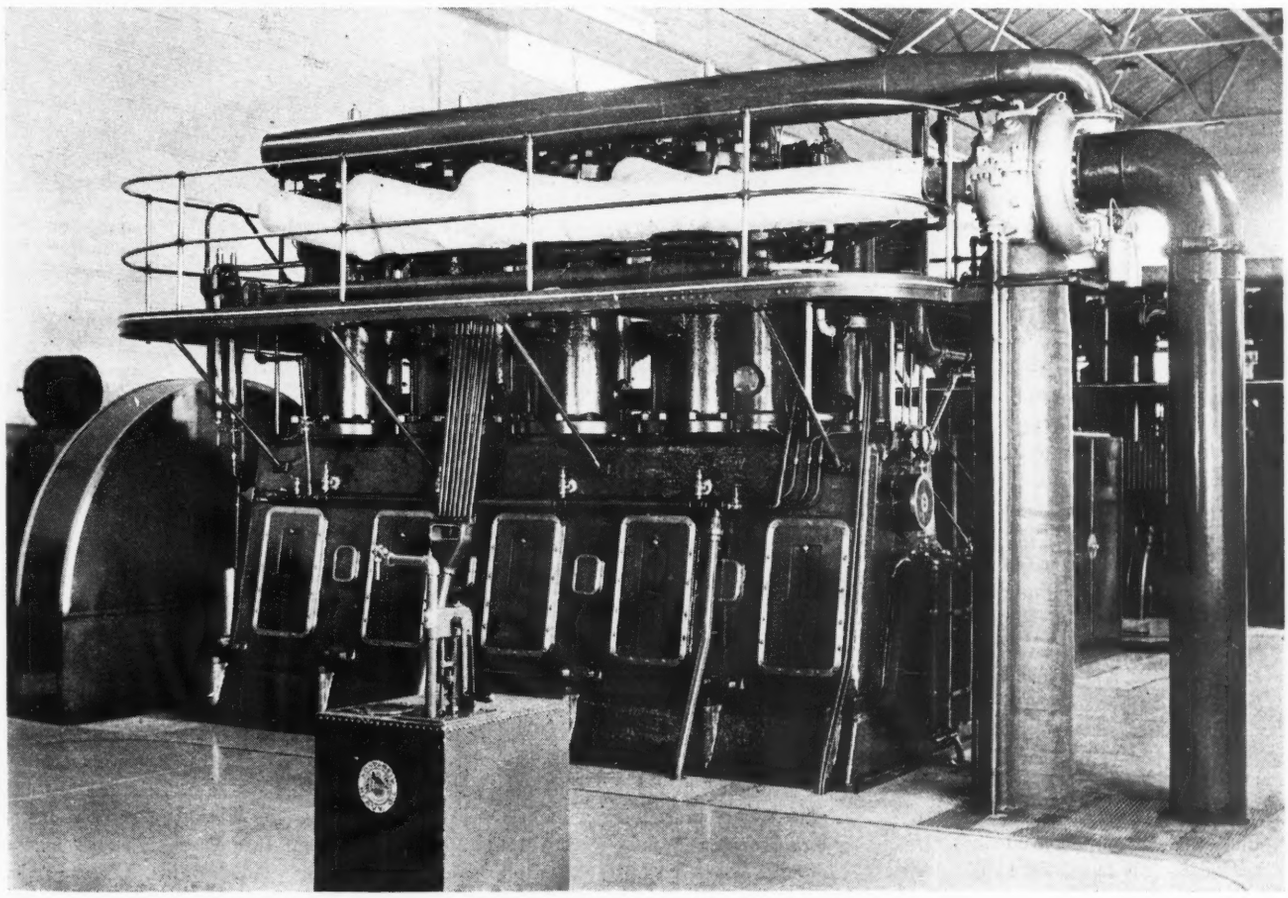
Passage through the turbine appreciably dampens exhaust pulsations. Muffler equipment thus presents no problem. Relatively less heat goes into the jacket cooling water because a greater percentage of heat is absorbed by the scavenging air and goes into the exhaust gas. In general, the heat exchanger installed for an unsupercharged engine suffices for a turbocharged engine of higher rating.

Performance Data

Fig. 1 shows turbocharged performance of a 6-cyl 13¼x7½-in. engine originally rated at 500 bhp and increased by turbocharging to 750 bhp, at 360 rpm, the original speed. Note the fuel-consumption curve's flatness and the reasonably low exhaust temperatures. This engine is representative of the type which can be supercharged successfully in the field with only moderate changes.

Before considering a turbocharger application, the engineer must first decide whether the power increase can be utilized effectively. In the case of a generating unit, this means a larger generator unless the existing unit is oversized. Existing generators now operating at less than unity power factor offer the possibility of increasing power factor to absorb additional load without major changes. On engines driving pumps, the output increase can sometimes be absorbed by stepping up the speed, when engine and pump designs

Fig. 2—Turbocharger installed on an existing engine in a pumping station operated by one of the major oil pipeline companies



permit, or changing the gear ratio.

Because of the need for careful engineering and because certain new engine parts are required when a turbocharger is installed, it is customary for the engine manufacturer to sponsor the application. Altered valve timing requires new cams or cam shafts. New exhaust manifolds, connections to the air-intake manifold, a mounting bracket, expansion joints and cooling-water connections are also needed. In some cases, new fuel-pump plungers and injection-timing alteration are recommended. In other cases, new valves and slight modifications to cylinder heads or piston crowns are necessary. In every instance, careful study ascertains the adaptability of the original engine design to turbocharging before the application is undertaken.

Installation, Operation

Installation and operation of the turbocharger involve no particularly difficult problems. The turbocharger itself is a rugged and simple machine; when assembled and installed properly reliable service can be expected with only a normal amount of operating attention. The principal requirement is an uninterrupted supply of clean lubricating oil under moderate pressure. Continuous circulation of cooling water through the turbine casing is also essential. In an emergency the engine may run with the turbocharger inoperative and nearly the original unsupercharged bmep rating may be carried.

A bracket attached to the engine frame usually supports the turbocharger, with the rotor axis parallel to the crank shaft. This arrangement permits the shortest and straightest exhaust manifolds to the turbine inlet. Expansion joints at appropriate locations in exhaust lines to and from the turbine compensate for temperature changes and relieve the unit of piping strains. Exhaust-manifold insulation minimizes heat radiation.

Blower intake air usually comes directly from the engine room and a silencer is attached to the blower inlet. In other cases, air comes to the unit from outside and an intake filter is provided if the air contains dust, excessive oil vapors or other impurities.

Cooling-water lines to and from the turbine casing, water jacket and lubricating-oil cooler connect to the engine cooling system; soft-water cooling is recommended.

Fig. 2 illustrates an Elliott-Buchi turbocharger installed on a 4-cyl 16¼x24-in. engine in a major pipeline pumping station. Turbocharging increased output from 450 to 675 bhp at 225 rpm; the load increase was absorbed by increasing the speed of the gear-driven oil pump.

Several standardized sizes of turbochargers, now in production, can be applied to engines with unsupercharged ratings from about 250 bhp to 1100-1200 bhp. With an engine of higher rating it is sometimes practical to install two turbochargers, one on either end. Each size can be adapted to a range of engine ratings by variation in the dimensions of a few internal parts. Flexible design permits different mounting and piping arrangements for various engines and numbers of cylinders.

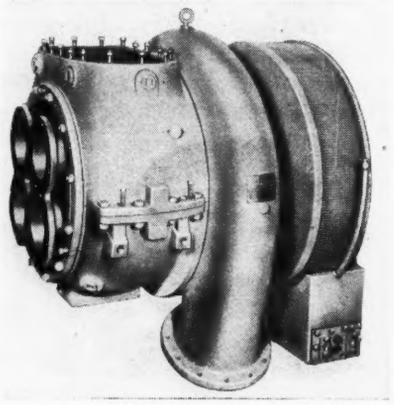
Fig. 3 shows a completely assembled supercharger. The turbine casing, an alloyed semi-steel casting, is water-jacketed. The steel turbine-inlet casting contains from one to four openings depending on the number of engine cylinders. These openings connect directly to the engine exhaust-gas manifolds through expansion joints. Use of heat-resistant materials in the nozzle ring avoids distortion under operating temperatures. The blower casing, a high-grade iron casting, bolts to the turbine casing and carries a cantilever bearing support. This supports the rotor from the blower end without need for a water-cooled bearing at the high-temperature turbine end.

Fig. 4 shows the completely assembled rotor. The turbine disk and blades are machined all over from a high-strength heat-resisting alloy. The blower impeller is closed. Steel-backed babbitt-lined sleeve bearings, lubricated by oil under pressure, support the rotor; bearing journals are superfinished. A separate self-contained lubricating system maintains turbocharger lubrication independent of engine lubrication. This system includes a gear pump driven from a shaft through reduction gears, an oil tank, an oil cooler and a filter. In some cases, the engine pressure system provides lubrication successfully, in which case a separate twin-filter element is furnished for the turbocharger oil supply.

Installation Cost

Cost of a turbocharger installation on an existing engine depends on individual conditions but a rather liberal estimate would be approximately $30-40 per hp *increase* in output, including engineering, turbocharger, manifolds, new engine parts and installation. Repeat applications on identical engines would be less costly because certain cost elements would be reduced or eliminated. Cost of turbocharger installations on new engines is materially less than the above figures.

The prospective user might ask, "Can turbochargers be procured under present conditions, assuming that it would help my particular power-generation problem?" The answer to this question is the same as for other critical machinery being used in the war effort—you can obtain delivery of turbochargers if your preference rating is high enough. These units are being produced regularly in quantities for Army, Navy and other government agencies. If your problem is of sufficient importance to warrant a high priority, turbochargers can often be delivered in less time than it would take to secure the same amount of additional capacity by installing complete new engines.



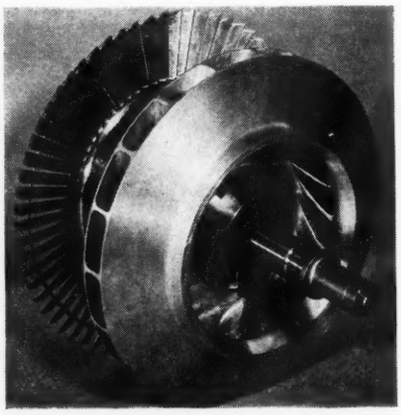


Fig. 3, 4—External view of completely assembled turbocharger unit and shop view of rotor looking into the blower-impeller inlet

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Beg Pardon

T C Beatty of Combustion Engineering Company, New York, N. Y., calls attention to an error in the lettering on the Mollier chart on page 117 of June POWER. The line marked "Constant Superheat Line" should be marked "Constant Temperature Line."

Boiler-Room Changes Double Output of Existing Units

Step-by-step modernization of boilers, feedwater system, firing methods and draft equipment yields needed extra steaming capacity and boosts efficiency as well. George H Urban* tells how the job was done at Marathon Paper Mills Co's Rothschild plant

▶ TODAY MOST INDUSTRIAL PLANTS face the problem of meeting ever higher steam demands without being able to obtain new equipment. The solution lies in "stretching" the capacity of existing equipment by a step-by-step study of the boiler room to find capacity limitations and by an intelligent program for removing the limitations when found. Experience at the Rothschild Division, Marathon Paper Mills Co, where a series of improvements doubled original boiler capacity and increased efficiency as well, shows what can be done with such a program.

The Rothschild Division, at Rothschild, Wis., includes a sulphite mill and bleach plant with 120 tons daily capacity, using hemlock, spruce and balsam. The mill comprises four paper machines, a board machine, two Fourdriniers and a Yankee machine, producing 170 tons a day of paper used mainly for food cartons and waxings. There are also various special coating and laminating machines.

Generating Capacity

Electrical generating capacity includes a large non-condensing corliss engine, two steam turbines and a hydro plant. For the comparatively short periods when river flow is low or extremely high, the steam plant and a utility transmission line supply the deficiency of hydro energy. Availability of low-cost hydro energy at most times has made installation of h-p boilers and turbines economically unjustifiable.

The main boiler plant consists of five boilers, 20 to 28 years old. These include four 3900-sq-ft 4-drum bent-tube units and one 8710-sq-ft straight-tube cross-drum boiler. There are also six 33-year-old Scotch marine units used to burn refuse from wood-room operations and hogged fuel from nearby sawmills. These old boilers serve as standby for the watertube units.

*Superintendent of steam plants, Marathon Paper Mills Co. This article is adapted from a paper presented by Mr Urban at the annual national meeting of the American Pulp and Paper Mill Superintendents Association, Grand Rapids, June 16-18, 1942, and published in *Paper Mill News*.

FIFTEEN STEPS TO INCREASED BOILER CAPACITY

Here's a quick summary of the improvements that doubled boiler capacity and increased efficiency at Marathon Paper Mills Co's Rothschild, Wis., plant:

Feedwater Circuit:

1. Improved condensate system to increase returns and reduce makeup needed
2. Installed steam purifiers and drum baffles to eliminate carryover
3. Overhauled feedwater-pumping equipment to increase capacity
4. Installed continuous blowdown with heat exchanger, which saved 2.5% fuel
5. Provided automatically controlled deaerating heater to eliminate oxygen

Firing Equipment:

6. Installed spreader stokers to burn low-grade fuels and give flexibility
7. Added meters, gages and combustion control for operating efficiency
8. Applied high-pressure overfire air to improve combustion at high ratings
9. Improved crusher and installed coal-mixing equipment to blend fuels

Boilers and Auxiliaries:

10. Replaced vertical baffles with cross baffles to boost first-pass surface
11. Increased economizer heating surface for higher efficiency
12. Installed sectionally supported air-cooled walls for lower maintenance
13. Replaced economizer bypass damper with gas-tight roller-curtain unit
14. Increased capacity of induced-draft system by overhauling driving units
15. Installed flyash collectors and returned flyash to furnace for burning

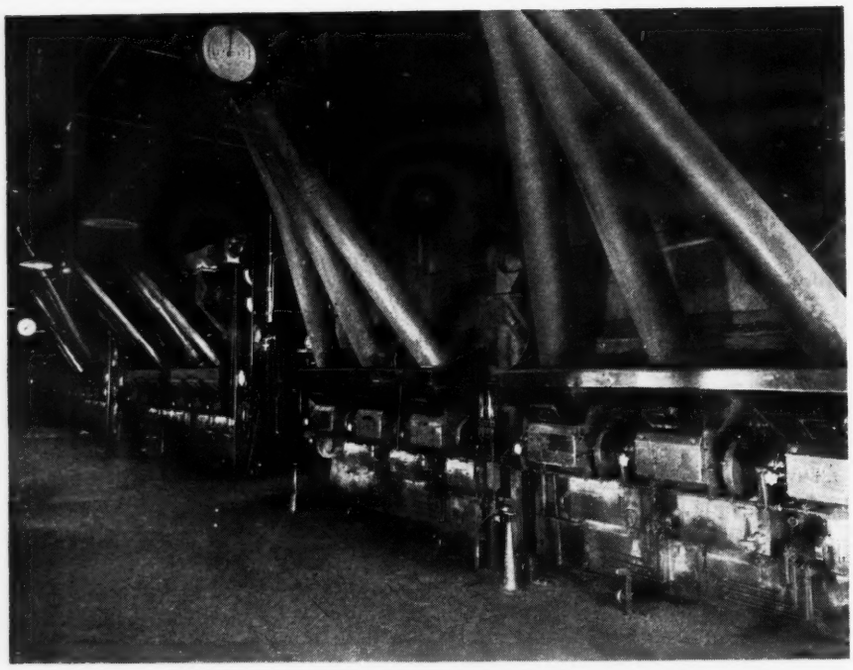
The first limiting factor which prevented high rating was bad water in the boiler drums, causing wet, dirty steam at high boiler loads. Closing up the condensate-return system and adding more collection and return equipment reduced the amount of raw makeup required, saving heat and treatment chemicals. The river water used for makeup contains a high percentage of organic matter but only small amounts of hardness. Internal treatment is closely controlled, according to daily tests of raw water and water from each boiler.

Installation of a direct-contact deaerating heater equipped with an automatic steam makeup valve which holds heater temperature at 212 F resulted in removal of most oxygen and some other gases. Each boiler was equipped with a steam purifier fitted with a rapid-dumping trap capable of handling large amounts of muddy water. These purifiers and traps reduce amount of moisture in steam to less than 0.5%. Internal steam-drum baffles help reduce load on the traps and prevent slugs of water from entering the steam nozzle. New feedwater regulators, operating on the differential-pressure principle, hold a safe water level with minimum fluctuation and thus further reduce the wet-steam conditions.

Additional steam output resulting from these changes and others presented later, meant need for more feedwater-pumping capacity, and new pumps were installed. The more efficient design of the new centrifugal pumps permitted operation with the old driving motors, no more power being required for the extra capacity.

A final improvement on the feedwater circuit consisted of installing a continuous blowdown system, with a heat exchanger. This gave cleaner boilers and drier steam, reduced amount of water-treating chemicals used and saved about 2.5% in fuel. This is a large saving considering the small investment, negligible operating cost, and low maintenance expense involved.

With former firing equipment, average monthly rating ran about 75% in summer and 120% in winter, for a yearly average of 115%. As load increased, spreader stokers were installed.



Spreader stokers handle a wide range of fuels, from anthracite and coke breeze to high-volatile low-fusion bituminous, and also burn reclaimed waste sulphite liquor

These are able to burn fuels ranging from anthracite screenings and coke breeze to bituminous coals having high or low volatile content and ash-fusion temperature. They also successfully burn reclaimed waste sulphite liquor, running about 50% moisture and 4000 Btu per lb. On this fuel, a continuous burning rate of 95 lb per sq ft can be maintained. With the spreader stokers, savings result from ability to burn small sizes, such as result from handling at mines and docks. We use 1/4-0 sizes when they are available.

The advantages of overfeed firing from our viewpoint can be summarized as follows: (1) equipment is simple and dependable, (2) maintenance cost and outage time are low because the few moving parts are outside the furnace (3) ability to burn efficiently a wide range of fuels in a low-set furnace, and (4) quick response to load changes.

Combustion Control

To get the most out of the new firing equipment, instruments and combustion control were installed. Flow meters indicate and record steam production; draft gages, recording pressure gages and thermometers, and steam-flow air-flow meters guide the firemen.

Steam demands of the pulp mill and bleach plant fluctuate widely, often varying at a rate of 100,000 lb per hr within a few minutes. These load changes are beyond the control of the steam-plant operators. To supply this swinging demand we installed a standard metering combustion control, with revisions of our own. With the stoker and auxiliaries capable of following steam variations quickly, the combustion control keeps steam pressure constant within a narrow range.

The bent-tube boilers, as installed, had standard vertical baffles. Replacing these with cross baffles reduced the possibility of short-circuiting, promoted efficient heat transfer and put more heating surface in the first pass. In addition, these baffles allow the soot blowers to do a better job.

The economizers originally contained smooth cast-iron tubes and headers. Replacing with extended-surface elements put more heating surface in the same casing. This boosted efficiency by lowering stack temperature.

Steam engines drove the induced-draft fans originally. Where possible, valve design was changed to increase engine power. In other cases, motors replaced the engines. In this way, available induced draft was increased to take care of additional gas and to compensate for resistance of flyash collectors which were needed.

We knew that flyash was a nuisance to ourselves and our neighbors and that there was considerable unburned carbon in the flyash which could be burned if practical equipment could be installed to collect it and return it to the furnace. The collectors installed rest on top of the brick lining inside our chimneys. Each collector consists of a double-walled metal cylinder with a stationary helicoid near the bottom which gives the stack gas a directional change. Cinders and flyash deflected by the helicoid travel around the inner jacket, ultimately passing through the collector into an annular space between the walls. Downward draft sweeps them into gravity conveyor pipes.

These collectors contain no moving parts and require no power. Draft loss is extremely low. The units are relatively inexpensive and take up no space in the boiler room. They have proved satisfactory and we have had no flyash complaints. The material collected in these units and that from the last boiler passes and the economizers returns to the furnace with high-pressure air. Burning this material represents a definite heat gain.

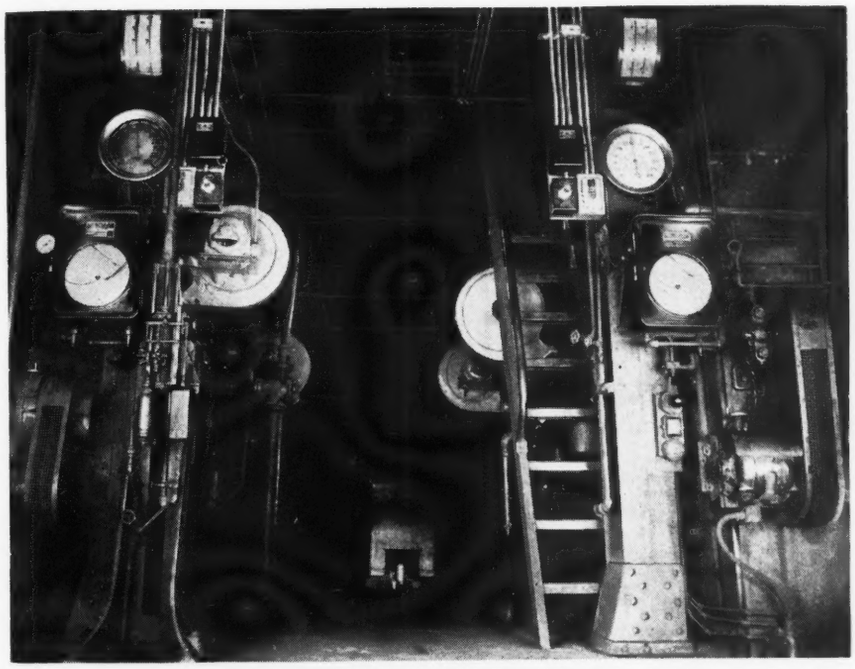
The fact that our boilers are set in battery and the general conditions of the installation made it impractical to install waterwalls. To reduce firebrick maintenance and outage from refractory failure, we installed sectionally supported air-cooled and insulated walls using intermeshed tile for battery walls, bridgewalls, arches and other parts of the furnace which get severe use. The supported walls have longer life, make repairs simpler and greatly reduce the number of bricks required for repairs.

Stop Small Losses

To maintain high efficiency month in and month out, we found that all small losses had to be stopped. Thoroughly insulating all steam and hot-water lines, insulating tops and settings of boilers and stopping all air leaks paid real dividends in fuel savings.

We realized that there was considerable leakage in the conventional breeching dampers caused by twisting, warping and settling of the breechings. The loss through our economizer bypass dampers was particularly bad; when breeching draft exceeded draft in the bypass flue to the chimney, chilled gas which had already passed the economizer was recirculated. When stack draft exceeded breeching draft, hot gas went around the economizer to the chimney. These conditions lowered boiler efficiency and capacity. We replaced these dampers with a roller-curtain damper which gave about 50-F increase in temperature of gas entering the economizer and about 200 bhp additional capacity.

We next set out to save fuel and increase effective capacity by saving steam in the boiler house itself. We installed a new steam-jet ash conveyor system which moved ash quicker, used less steam and cut maintenance cost. Other savings were made by using air heaters to reclaim heat in excess low-pressure steam at times when it cannot be utilized by the feedwater heater, and by reducing amount of steam used for



These blowers, mounted at sides of furnaces, supply high-pressure overfire air, creating turbulence, eliminating stratification and increasing burning rates

soot blowing by always blowing as little as necessary to keep the tubes clean.

To take advantage of the many types and sizes of coal available and to be ready for any restrictions in supply, we rebuilt our coal crusher so it would crush to smaller maximum sizes. In order to burn degradations, excessive fines and byproduct fuels we installed coal-mixing equipment so that we can blend different coals. In this way we can successfully burn many coals which cannot be burned efficiently by themselves or which would not meet our capacity needs when burned alone.

Add Overfire Air Blowers

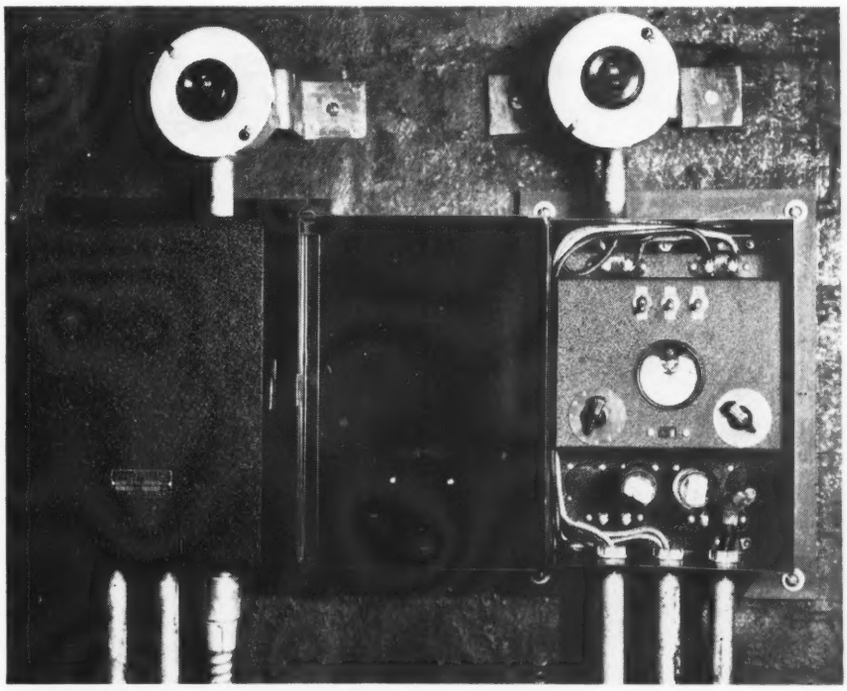
After making the changes and additions outlined thus far, we thought we had gone as far as we could in getting greater steaming capacity from our present equipment, and without rebuilding the entire plant there seemed to be no practical way of increasing ratings further. Then we investigated and experimented with high-pressure overfire air and found we could substantially increase the already expanded steam production. We installed this equipment on all furnaces in the Rothschild and Menasha Divisions.

These high-pressure overfire-air installations include unique blowers which deliver air at a pressure of 30 in. of water and yet which are small and light enough to be mounted or hung on the boiler setting itself. The high-pressure air from the blowers enters the furnace through a series of manifolds and nozzles. The exact details vary on each installation, but in general the air streams in the furnace are parallel rather than tangential. The high degree of turbulence produced insures complete combustion even at high ratings. The blowers are arranged so that one or more units operate at all boiler loads; when load increases sufficiently to cause smoke, an "electric eye" control cuts in another fan. A time-delay device keeps this unit operating for a short time after the smoke clears, to prevent the intermittent action that would follow a series of puffs.

Some indication of the improvement resulting from use of overfire air can be gleaned from capacity and efficiency figures. These are averages over periods of a month each and include losses caused by manufacturing shutdowns, banking, removing boilers from service for weekends, etc. Before the overfire air installation, peak-load ratings approached 240% and the highest monthly average obtainable was 175%. With overfire air, peak-load ratings ran up to 290% and monthly average reach 205%, with more capacity available if needed.

Boiler efficiencies vary with ratings; without overfire air, over-all boiler and economizer efficiency ran about 81.5% when average ratings did not exceed 155%, and at 175% rating efficiency dropped to 79.0%. With overfire air, average monthly efficiency comes to 84.0% when average monthly ratings do not exceed 175% and from 175 to 205% rating the monthly efficiency now averages 82.4%.

The overfire-air installation saves about 3% in fuel, reduces clinkering on grates and walls, broadens the range of efficient operation, reduces combustible in ash, permits burning of lower-fusion-temperature coals, increases burning rate per sq ft of grate surface, reduces flyash by about 50% and cuts tube slagging and need for soot blowing. We were satisfied that overfeed stokers alone gave fast steam pickup but with overfire air as well we get a steam pickup that approaches that possible with powdered fuel.



This photoelectric device controls operation of overfire-air fans. Normally, one or more blowers supply overfire air; if high-rating operation causes smoke, the "electric-eye" automatically cuts in another blower. A time-delay device prevents "hunting"

Motors for Power-Plant Pumps Meet Special Requirements

K M Patterson, generator division, Westinghouse Electric & Mfg Co, gives practical pointers on selecting motors for boiler-feed and condenser-circulating-water pumps, to meet requirements of reliability, speed control, noise level and pump charactetristics

▶ MOTORS TOTALING 400,000 HP will be required for driving auxiliaries to operate the turbo-generators purchased during the last year for central-station power plants alone. Power for auxiliary drives averages 8 hp per 100 kw of generator capacity; and motor cost averages about $1.00 per kw of generator capacity. Because of their specialized requirements, the application of motors for driving boiler-feed, condensate, and circulating pumps typifies the care required in selecting proper motors for power-station auxiliaries.

Boiler-feed pumps for high-pressure stations generally operate at 3600 rpm for 35,000-kw units and larger, and require motors rated from 800 to 2500 hp. Constant-speed squirrel-cage induction motors are used, sometimes operating with constant or variable-speed booster pumps, at others with a variable-speed turbine. The turbine drive may be used to vary the quantity of water delivered, to provide additional reliability, to work out a proper heat balance, or for a combination of these reasons. Smaller generating units and lower-pressure units may use boiler-feed-pump motors operating at 1800 rpm.

Large Induction Motors

Fig. 2 shows two typical 2-pole 3600-rpm 1000-hp squirrel-cage motors driving two high-pressure centrifugal pumps. Motor frames are fully protected from moisture, falling objects, and splashing water. The enclosed construction also reduces the noise level. In this station, air is received by the motors at each end through openings in the bottom halves of the bearing brackets. After passing through the motor coils and core, the heated air discharges downward from the frame on each side of the motor, near the floor line.

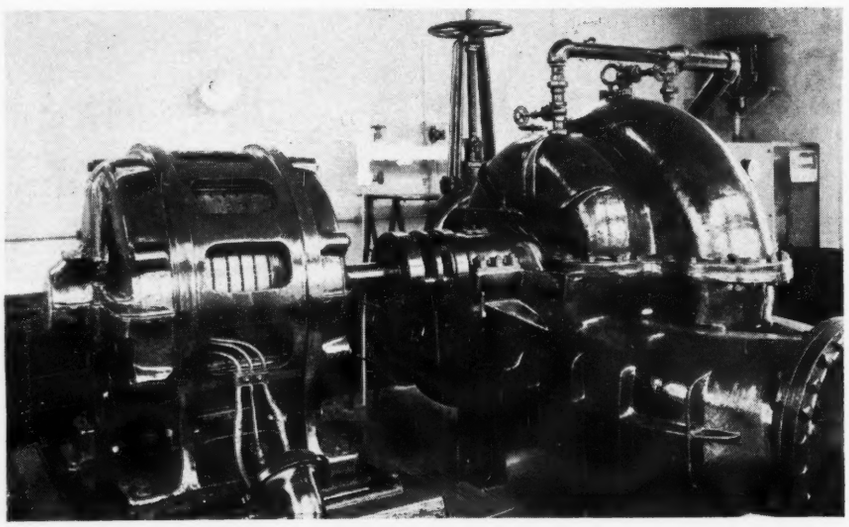


Fig. 1—Open 200-hp 450-rpm constant-speed squirrel-cage motor drives circulating pump. Similar motors with frame covers to protect against falling water are available

It is usual practice to use welded steel frames and bearing brackets on the motors, Fig. 2. This construction lends itself to mechanical variations in frame design to provide for base ventilation. In this system of ventilation the air may be taken into the motor from above the floor line, or through ducts below the floor, and discharged from the motor through the base and the floor into the room below. The construction may also provide for a chimney arrangement with air discharged upward from the motor either directly into the pump room or outside.

The motor installation, Fig. 2, has a noise level at the motor of about 100 decibels, which can be reduced by discharging the ventilating air downward through its base or upward through a chimney frame. Because of high operating speed, boiler-feed-pump-motor noise levels may range slightly higher than those of other auxiliary motors, but the latest designs come within the noise level of turbines, fans, pulverizers and other station machinery. Even greater reduction in noise level may be obtained by equipping the motors with an enclosed ventilating system with air coolers like those of turbine generators. These can be applied readily to large feed-pump motors.

Other Auxiliary Drives

The foregoing typifies 2-pole induction motors, 600 hp and larger, for boiler-feed-pump drives. Other auxiliary pumps usually require smaller motors built more nearly along standard lines, frequently operated at 1800 or 1200 rpm. These motors range from open, drip- and splash-proof to totally enclosed self-ventilated designs.

Two types of low-speed induction motors are generally used for lowhead circulating-pump drives. Horizontal centrifugal and mixed-flow pumps need horizontal motors; and propeller and axial-flow pumps require vertical

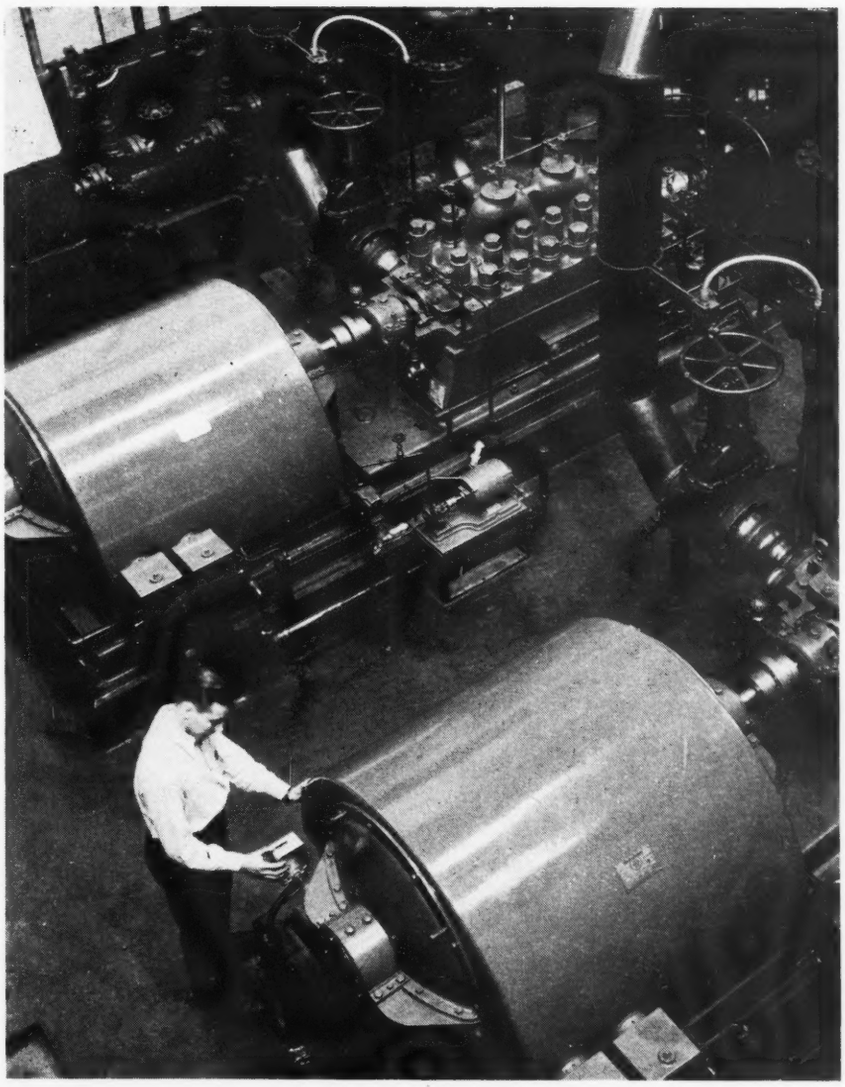


Fig. 2—Enclosed construction of 1000-hp 3600-rpm induction motors driving high-pressure boiler-feed pumps protects them mechanically and reduces noise level

motors. Fig. 1 shows a typical 200-hp open horizontal squirrel-cage motor driving a circulating-water pump. Similar motors with frame covers added to protect against falling water are available. Fig. 3 shows a 2-speed motor of this design. Vertical motors also are often installed with protective covers, even to the extent of making them suitable for outdoor installations.

Pumps in Parallel

Where two circulating pumps operate in parallel, one pump motor may have its power accidentally interrupted. When this occurs, the other pump continues to run and tends to pump water through the disconnected unit in a reverse direction. Under some conditions the disconnected motor may be driven at overspeed by its pump running as a turbine. Mechanically, motors can be built to withstand overspeeds up to 100 or even 200% normal speed. Ordinary motors of conventional design are good for 25 to 50% overspeed, depending on the size. Therefore, where two circulating-water pumps operate in parallel on one condenser, electrical characteristics of the motor and speed-torque characteristics of the pump when operating in a reverse direction must be considered carefully.

Reverse Operation

As shown in Fig. 4, a pump operating at normal speed in a reverse direction will develop 54% full-load torque, as indicated at *A*. If power is applied to a standard squirrel-cage motor under this condition it will develop only 42% torque, as indicated at *B*, which is not sufficient to cause the motor to bring the pump to a full-load standstill. Curve *B* is the speed-torque characteristic of a conventional squirrel-cage induction motor having 60% starting torque and approximately 200% full-load pull-out torque. A special squirrel-cage motor with the speed-torque characteristic, curve *C*, might be applied for this particular drive. It has 80% starting torque and 220% pull-out torque. This motor, if connected to the line while driven at normal speed in the reverse direction, would develop 65% starting torque which would be sufficient to overcome the torque of the pump being driven as a turbine, and accelerate it back to normal operation at full speed.

When operating generator units at reduced load it is sometimes advantageous to decrease circulating-water flow through the condensers, but this cannot be done economically by throttling the pump. Using two or more

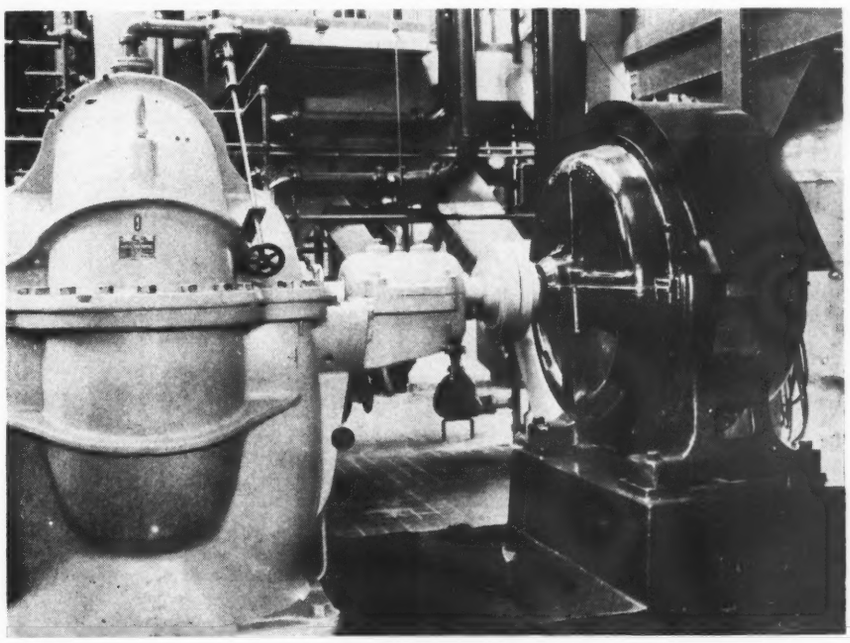


Fig. 3—This protected 250-hp 2-speed squirrel-cage motor drives a condenser circulating-water pump at either 192 or 316 rpm as required by station load conditions

pumps in parallel, so some of them can be shut down during light load, is satisfactory, but this arrangement increases the investment in pumps and piping. Variable-speed operation saves power and permits the pump to operate with good efficiency at reduced capacity. Several methods are used to vary speed of pumps or fans, which in general have similar torque characteristics when applied to power-station auxiliary drives. Common methods of speed control include: two motors of different horsepower and speeds on the same unit, 2-speed motors, constant-speed motors with hydraulic couplings, constant-speed motors with magnetic couplings, and wound-rotor motors with secondary control.

Slip-Device Efficiency

The last three are slip devices the efficiencies of which decrease in proportion to the speed. That is at 80% speed or 20% slip the loss is 20% of the input plus the motor losses at the torque load required by the driven machine, or perhaps an overall efficiency of 75%. At 60% speed the efficiency might be around 55%. All of these drives, the hydraulic coupling, magnetic coupling and wound-rotor motor with secondary control, have losses and efficiencies of the same order. Power losses with wound-rotor motors are slightly less than the other two, because they have fewer bearings, less windage and friction, and fewer auxiliary devices such as excitation, fluid pumps, etc.

Fig. 5 compares the efficiency of three types of slip equipment available for variable-speed drives. The efficiencies are figured on the basis of a load that varies as the cube of the speed and includes all losses that are encountered with each drive.

Hydraulic and magnetic couplings would be difficult to apply to vertical drives, as would two motors driving a single pump. However, 2-speed motors and wound-rotor motors are satisfactory for vertical applications.

Assuming that no in-between operating points are required, a 2-pump arrangement forms perhaps the most economical solution, not considering the first cost of two pumps, motors and control. Reliability may be greater because part-capacity operation is possible with one pump out of service. Efficiency of a 500-hp 360-rpm induction motor is approximately 90% at full load and that of a 250-hp 450-rpm induction motor is approximately the same. Assuming that the smaller pump operates at a higher speed as in the example, one half of the pumping capacity should be obtained at the same efficiency as full capacity as far as the drive is concerned.

Modern Liquid Rheostats

Liquid rheostats, while old and well known to electrical engineers, have been introduced only recently for variable-speed power-plant auxiliary drives. Some of these liquid rheostats of modern design are used with large variable-speed wound-rotor motors driving dredge pumps. Several rheostats are now being built for powerhouse auxiliary drives including three units for variable-speed fan drives and one for low-speed variable-speed pump drive.

The complete assembly of electrodes, sump tank, cooler, and circulating pump for a liquid rheostat is built as a unit and requires no assembly in the field except the motor secondary lead connections, the cooling-water pipe connections and the control circuit or devices.

Synchronous Motors

Recently, use of synchronous motors for large constant-speed drives, except 3600-rpm boiler-feed pumps, has been given some consideration. In most cases the synchronous motor will cost somewhat less than an induction motor for large low-speed pump drives. In addition, synchronous-motor efficiency is higher than that of induction motors of comparable size. Synchronous motors may be operated at unity or at a leading power factor, where induction-motor power factor, particularly on low-speed ratings, is a rather low and lagging. Synchronous motors of modern design with field-control equipment now available are about as stable during station-power-supply disturbances as are induction motors.

Synchronous-motor field control not only applies field excitation at the correct time and speed, but also at the correct angular position between the stator voltage and rotor position to give the most positive synchronizing action. Direct current is necessary to excite the field of a synchronous motor, but this may be considered no more objectionable than cooling water, fluid pumps, and auxiliary power required for various other pieces of equipment.

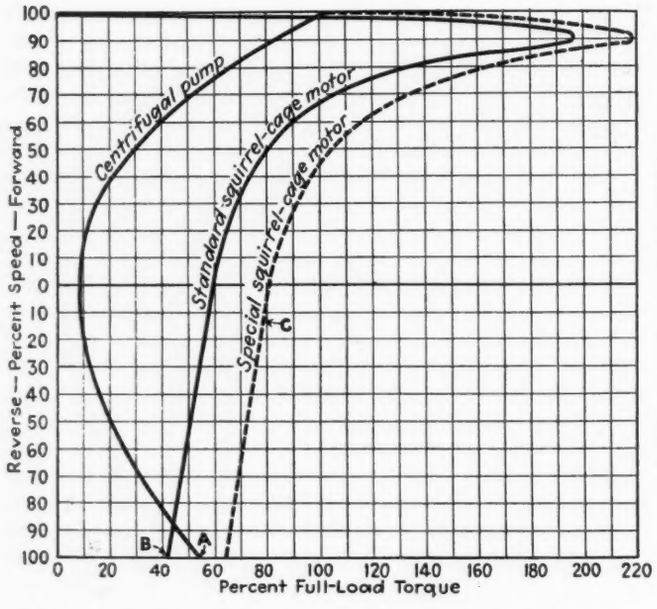

Centrifugal pump
Standard squirrel-cage motor
Special squirrel-cage motor
A
B
C
Reverse — Percent Speed — Forward
Percent Full-Load Torque
100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100
0 20 40 60 80 100 120 140 160 180 200 220

Fig. 4—Speed-torque characteristics of a standard squirrel-cage motor, a special squirrel-cage motor and a centrifugal circulating pump running in forward and reverse directions

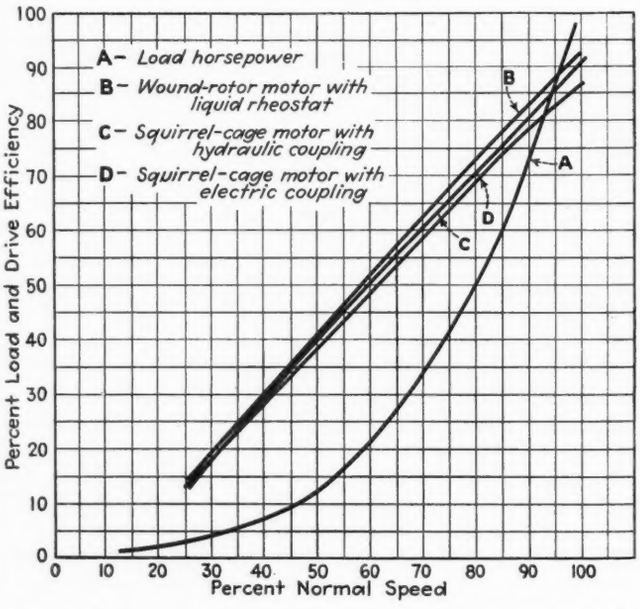

A— Load horsepower
B— Wound-rotor motor with liquid rheostat
C— Squirrel-cage motor with hydraulic coupling
D— Squirrel-cage motor with electric coupling
Percent Load and Drive Efficiency
Percent Normal Speed
100 90 80 70 60 50 40 30 20 10 0
0 10 20 30 40 50 60 70 80 90 100

Fig. 5—Drive-efficiency curves of a wound-rotor motor with liquid-rheostat control, a squirrel-cage motor with hydraulic coupling, and a squirrel-cage motor with electric coupling

Make Deaerating Heaters Suit Plant Cycle—I

Direct-contact heaters will do a good job of removing oxygen from feedwater as well as contribute to over-all efficiency if you follow the principles laid down here by Warren P Spining, application engineer, Worthington Pump & Machinery Corp

► FITTING AN OPEN FEEDWATER HEATER into a boiler-feed system was once a comparatively simple matter. All condensate and exhaust steam was brought together at one point in a cast-iron tank ahead of the boiler-feed pump. Today, however, selection of the best heat balance for over-all plant efficiency imposes several mechanical problems on the designer.

High-pressure boilers operate at high ratings with small water-storage capacity and require almost perfect deaeration of feedwater. They also must have emergency water supply instantly available somewhere in the system.

Multi-pressure steam systems offer a wide choice of heater operating pressures. With bleeder turbines, deaerating heaters may be required to operate at pressures which vary with load. Use of centrifugal boiler-feed pumps definitely limits minimum height at which the heater can be located.

These factors, all beyond the scope of the usual heat-balance studies, have received less written discussion than the well-understood contribution of one or more feedwater heaters to over-all power-plant efficiency. The need for deaeration is also now an admitted requirement of all steam plants, including those operating at low pressures.

The most satisfactory and most reliable method of deaeration is by means of *open* or *direct-contact* deaerating heaters. The terms *open* and *direct-contact* have come to be used to describe any heater in which water and steam mix, whether or not at atmospheric pressure.

Assuming that a direct-contact deaerating heater is to be made part of the steam system, then location of the heater in the boiler-feed cycle in relation to other items of equipment depends on the pressure levels at which exhaust or bleed steam can be made available. In the small plant there is seldom much choice. Low-pressure auxiliary exhaust may range from 2 to 30 psi gage, depending on other requirements, such as process or heating.

Whatever the pressure within this range, the simplest arrangement, Fig. 1, will probably serve best. Plant conditions should be checked to make sure that an adequate amount of steam is available and that pressure can be maintained fairly constant at all times. Otherwise, deaeration cannot be maintained effectively. Gradual pressure variations are not detrimental but sud-

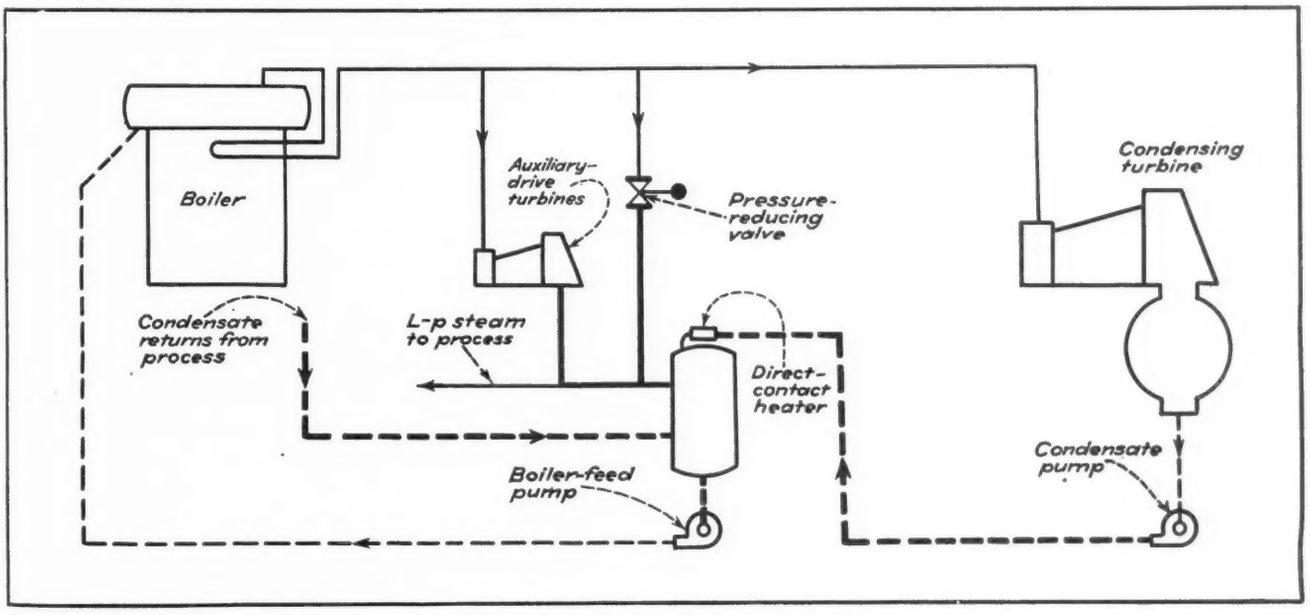


Fig. 1—Auxiliary exhaust plus live steam from pressure-reducing valve assures adequate supply of constant-pressure steam for deaerator. Pressure should be regulated by suitable controls governing steam supply from an unlimited source

den fluctuations interfere with proper functioning of the heater. Suitable steam controls may be required to hold pressure constant.

In more-elaborate plants for process industries, steam may be available at several pressures, as in Fig. 2. For these, heat-balance studies indicate which pressure can be utilized most economically for feedwater heating. Practical considerations, such as, (1) control of the steam source at reasonably constant pressure under all load conditions and (2) mechanical design of heater, enter this picture. Steam pressure should preferably be within a range of 2-52 psi gage. The lower limit is indicated by the necessity of continuous venting of oxygen and other non-condensible gases from the heater to prevent air binding and assure deaeration and the upper by practical design requirements of the ASME Code for Unfired Pressure Vessels.

Pressure Limits

Special equipment can be provided to vent deaerators under vacuum conditions, but additional cost must be incurred. Most heaters can, if necessary, be designed for pressure as low as 1 psi gage without special equipment. However, it is more practical to set 2 psi as the lower limit to provide a slight margin for abnormal conditions.

The upper limit involves a temperature limitation of 300 F specified in paragraph U-69 of the Code for Unfired Pressure Vessels. It is considered good practice to design all direct-contact heaters operating at pressures over 15 psi gage in strict accordance with this Code. Pressures over 52 psi gage would involve temperatures over 300 F and would therefore require the more expensive paragraph U-68 construction which includes X-raying all welds and stress-relieving the entire vessel after welding has been completed.

The arrangements of Fig. 1 and 2 are based on the availability of exhaust or extraction steam at constant pressure. For large condensing-turbine installations, however, a gain in thermal efficiency for the over-all plant usually results from heating feedwater with steam from uncontrolled turbine-extraction points as shown in Fig. 3. Admission of evaporator vapor and high-pressure heater drains directly to the deaerator can easily be accomplished in such a system. (See POWER, April 1942, page 60).

Steam pressure at any uncontrolled bleed point varies approximately in direct proportion to steam flow through the turbine and consequently in proportion to deaerator load. For example, an extraction stage pressure of 50 psi abs at full load may drop to 10 psi abs at 20% load. Such pressure changes, if they occur gradually, have no ill effect on the deaerating ability of the direct-contact heater. Rapid pressure fluctuations, however, may adversely affect deaeration. In large central stations loads may vary widely over a period of several hours but momentary changes are usually small compared to total load. Such plants can therefore utilize steam at varying pressure from uncontrolled bleed points satisfactorily.

Industrial power plants, on the other hand, particularly those producing power for operating heavy machinery, may have sudden load changes amounting to a high percentage of their total load with consequent violent fluctuations in steam pressure from an uncontrolled bleed point. A direct-contact heater cannot perform properly with violent pressure changes. The manner in which pressure changes occur should, therefore, receive serious consideration in choosing between operating a direct-contact heater from an uncontrolled bleed point or from some constant-pressure source.

In selecting the bleed point for direct-contact-heater supply, the advisability of remaining within the pressure range from 2-52 psi gage should be considered. Some conditions, however, can justify the additional first cost of heaters designed for higher pressures or for vacuum conditions.

In determining the capacity rating of direct-contact heater required, the usually accepted measure is the total number of pounds of heated water leaving the heater storage compartment. This includes all condensate, makeup and high-temperature returns entering the heater, plus the amount of steam condensed in the heater. Thus, maximum amount of heated water required at the heater outlet determines the rated capacity of the required heater.

While most well-designed deaerating heaters will handle considerable overload under steady pressure, temperature and flow conditions, such favorable influences cannot be assured in actual operation. Manufacturers' guarantees of deaerating effect are therefore limited to rated capacity. Heaters should be bought for maximum expected loads.

Manufacturers do, however, make supplemental oxygen-removal guarantees at overload ratings, but at increased oxygen carryover values. A deaerator guaranteed to deliver 600,000 lb per hr of water containing not over 0.005 cc of oxygen per liter might carry a supplemental guarantee to deliver 650,000 lb per hr containing not over 0.03 cc per liter. The same heater might also be guaranteed to deliver 700,000 lb per hr heated within 2 F of saturated steam temperature with no oxygen value specified at this higher overload rating. These facts should be taken into consideration where infrequent short-time overloads are expected.

The degree of deaeration required for any given boiler is a matter for mutual decision between operator and boiler manufacturer. In general, however, the standard guarantee of 0.03 cc per liter by Winkler test is satisfactory for pressures below 250 psi, except where steel-tube economizers are to be used. In the latter case, and for higher pressures up to 2500 psi, a guarantee of 0.005 cc per liter by the Schwartz-Gurney modification of the Winkler

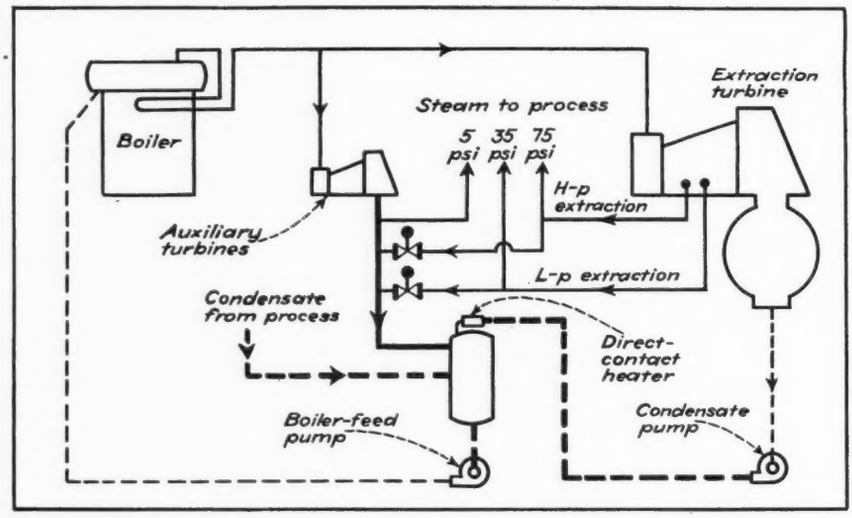


Fig. 2—Where several pressure levels are available from extraction turbines, practical considerations determine choice among the three possible pressure levels

test is recommended. The latter is approximately equivalent to 0.00 cc per liter by the Winkler test but is more accurate.

These figures are given only as a rough guide and will be affected materially by design and rating of a particular boiler installation. Recommendations of the boiler manufacturer should be the final authority.

The deaerating heater is a convenient point for storage of oxygen-free feedwater (1) to take up changes in volume of water in the steaming cycle caused by load changes, (2) to provide an emergency supply of water for the boilers in case of accidental failure of normal sources of condensate or makeup and (3) to reduce load fluctuations on the heater.

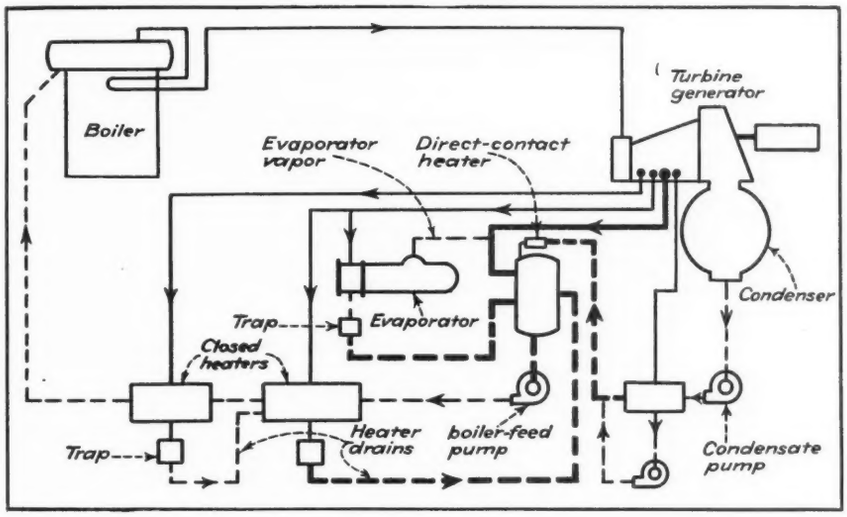


Fig. 3—For large condensing-turbine installations deaerator steam supply usually comes from a bleed point which remains above atmospheric pressure at all loads

An amount of water storage equal to about two minutes steaming at full load is generally considered to be a minimum. Additional storage above this amount is often advisable. For example, a steam plant supplying heating steam to a large institution may have a heavy "pick-up" load in the early morning during which steam is sent out at a much higher rate than returns come back. Unless considerable condensate is stored in the deaerating heater or a surge tank, a large amount of makeup must be introduced that must later be wasted. The same problem to a lesser extent applies to all process and electric-generating plants.

In addition, some storage is essential to provide emergency supply for boiler feed. High-pressure boilers have little self-contained water storage and emergency supply is of vital importance.

Some storage of deaerated water is important to reduce load fluctuations on the heater. Particularly in small industrial plants, there may be periods when the demand for feedwater far exceeds the average load. Sudden withdrawal of water from the heater drops the level in the storage section until the inlet regulating valve opens wide, admitting cold water at a high rate of flow. This greatly increases demand for steam and may cause heater pressure to drop below atmospheric, opening the vacuum breaker and drawing air into the heater.

When and if this happens, the heater cannot deaerate properly until pressure has been restored and all the air vented. On the other hand, if the heater had greater storage capacity, the momentary demand for water would lower the water level to a lesser extent, increasing the cold-water inlet flow by a smaller amount and holding steam flow within reasonable limits.

There can be no set rule for figuring the amount of storage required for best operation in a given system. Requirements of various plants differ widely. Whether it is better to build storage into the deaerator or in a separate surge tank ahead of the heater is a matter for individual case study.

Storing heated and deaerated water in the direct-contact heater usually involves higher first cost and greater radiation losses. This method of storage, however, serves all three previously mentioned basic purposes for which storage is required. A separate surge tank ahead of the heater takes up changes in volume and provides emergency storage if properly arranged with suitable bypasses, controls and alarms, but has little effect on reducing momentary heater loads caused by sudden peaks in boiler demand. Some compromise between the two is usually most satisfactory.

The amount of "net positive suction head" required at the suction of the boiler-feed pump, determined by the pump manufacturer, is actual head above the vapor pressure of the water. Since a direct-contact heater raises water temperature to that of saturated steam at heater pressure, the vapor pressure of the water will be exactly balanced by the steam pressure in the heater.

This means that heater pressure and water temperature need not be considered where a boiler-feed pump takes its suction from a direct-contact heater. The net positive suction head will be equal to the static elevation of the water level in the heater above the pump minus pipe friction, regardless of water temperature or steam pressure in the heater.

Actual elevation of the heater should always be sufficient to provide the recommended net positive suction head with water in the heater storage compartment at minimum level. If there are likely to be occasional sudden steam pressure drops which would cause flashing in the heater storage, additional elevation should be allowed as a precautionary measure.

Avoid Flashing

The heater should be mounted at a point as nearly over the boiler-feed pumps as possible and the piping should be short and direct. Horizontal runs should be meticulously avoided unless they are well below heater level. For example, a horizontal run with several fittings only 3 ft below heater level might easily have a 3-ft friction loss at peak flow and flashing would occur in the line. Were the horizontal run 15 ft below heater level, this cause of flashing would be eliminated.

A further precaution calls for pitching all horizontal runs of boiler-feed suction piping steeply downward toward the pump. Water velocities should be kept low, preferably not over 2 ft per second. If the pipe is of ample size, any vapor formed will rise to the heater without vapor-binding the pipe and impeding flow to the pump.

Having determined the required size of heater, oxygen-removal guarantee, amount and arrangement of storage and the location of heater in both the operating cycle and physically within the plant, remaining problems concern arrangement of surge tanks, selection of accessories and methods of control. These will be discussed in a future article.

How to Anchor Pipe Hangers In Concrete

In steel-frame buildings anchoring pipe hangers is fairly simple but when reinforced-concrete construction is used the problem is not so easily solved. Arthur H Korn* shows how to install anchor inserts that are strong and yet allow for out-of-line conditions in concrete and tile

▶ ONE OF THE SUBJECTS most neglected in the field of mechanical engineering is the fastening of pipe hangers and brackets to reinforced concrete. No information on this subject can be found in piping literature. Connecting pipe hangers to steel structures presents few difficulties because clamps for all kinds of structural shapes are manufactured commercially. Besides, it is easy to bolt straps or even weld brackets to I-beams, channels and columns. On the other hand, the difficulties of connecting pipelines to reinforced concrete are manifold.

If a pipeline is to be installed in an existing building and the design makes no provision for fastening hangers and supports, there is no alternative but to drill the concrete for expansion bolts or to cement anchor bolts or inserts in chiseled holes. This is an awkward, expensive and not always reliable method that should never be used when a new industrial building is designed and a complete machine layout is made. In drilling beams and slabs, reinforcing may be cut or otherwise weakened.

However, providing properly located inserts in new buildings has often proved to be a source of trouble, delay and expense. When the mechanical equipment is installed the inserts are rarely found in the right places. The fault usually lies with the designer because it is almost impossible to make him understand that the accuracies he is used to are beyond realization in the building trades.

Allow Plenty of Leeway

There are adjustable inserts on the market; the leeway most of them afford amounts to $\pm\frac{3}{4}$ in. That may be entirely sufficient for piping which is part of the building such as plumbing, electrical conduits, and sprinkler systems. For pipelines which connect mechanical equipment a much greater leeway is required, if for no other reason than that the machines and the mechanical equipment itself cannot be located with much precision. In addition, last-minute changes in the machine layout usually cannot be avoided. Alterations during installation are the rule rather than the exception.

Hangers, supports and other connections of mechanical equipment to masonry and concrete should be so designed that a misplacement of inserts of at least several inches in any direction does not render their use impossible or make the connection difficult or unsightly. This is a rule easy to observe once recognized.

If the floor of a building is of reinforced-slab, beam, and girder construction, a sleeve run through the beam as shown in Fig. 1 provides a simple, reliable and inexpensive insert. The pipe then can be hung by means of a clevis and a screw rod which permits vertical adjustment. It is most advantageous to run the pipeline parallel to the centerline of the beam because of the ease with which lateral adjustments can be made, in this case by using an unsymmetrical clevis. If conditions are such that the pipe has to run between beams it can be hung in a somewhat similar manner from the girder. It is then best

* Chief Engineer, Holly Pneumatic Systems Inc.

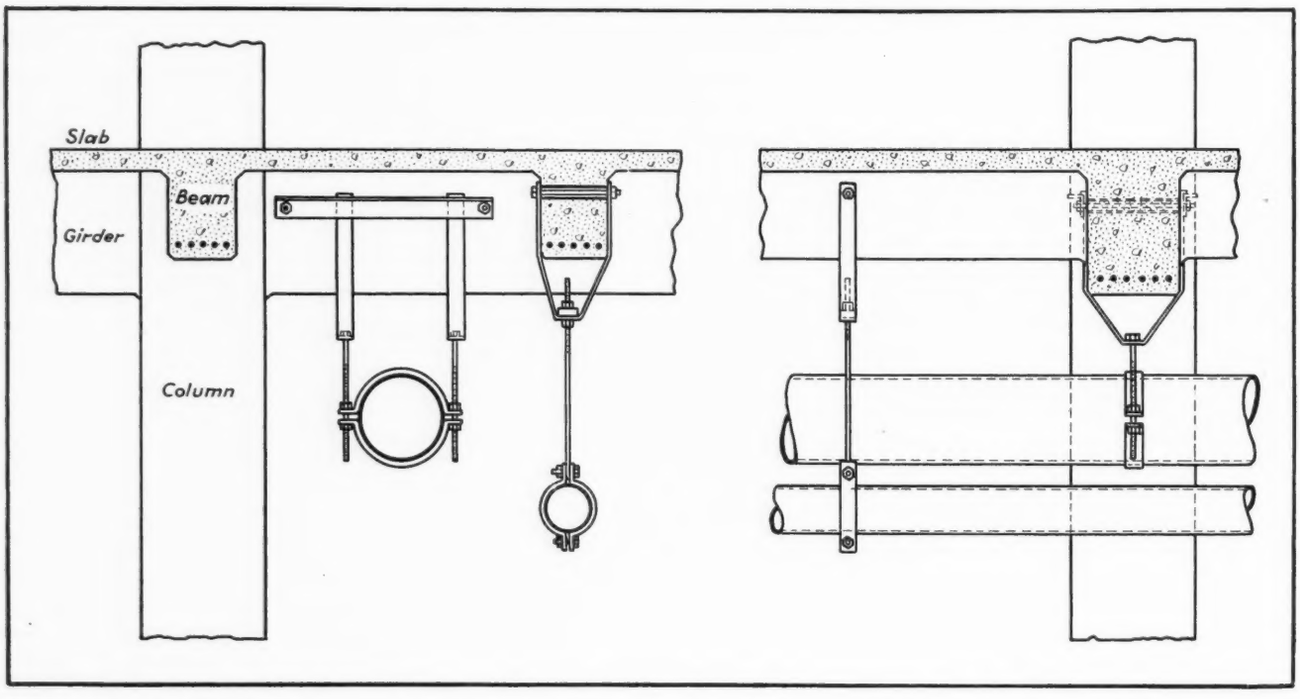


Fig. 1—Clevis and screw rods fastened to beams or girders permit lateral adjustment of hangers to agree with pipe centerline

to provide sleeve inserts in pairs to facilitate lateral adjustments. The latter hookup is also advisable for beams when the pipe runs at right angles to the beams. The sleeve inserts or ferrules can be provided at regular intervals in all beams, regardless of the original piping layout, to take care of unpredictable future extensions and alterations. The sleeves are not unsightly when not in use because they do not project and only need to be large enough in diameter to take the bolt.

Ferrules rolled from sheet metal and of a diameter large enough to take the pipeline itself are sometimes provided in reinforced concrete beams for systems of a more permanent nature such as sprinklers. Adjustments are then only possible to the extent that the holes in the beams are oversize, so that the pipe can be cemented in place out of center. This method is hardly applicable for industrial piping because it lacks flexibility and alterations are exceedingly difficult.

Fig. 2*A* shows an insert consisting of a nut and washer embedded in the concrete. The pipe sleeve shown is necessary only to hold the nut in place while the concrete is poured. However, as far as reliability and adaptability are concerned this insert is by no means on a par with the kind shown in Fig. 1. It can be used to advantage for indirect connections to fasten timbers to the ceiling to which in turn machine parts such as lineshaft hangers can be screwed. The designer might be warned against hesitating to provide holes in the concrete of adequate depth and threaded portions on the screw of ample length to make sure that the timbers are drawn tightly against the ceiling by the screw head before the point of the screw reaches the bottom of the hole.

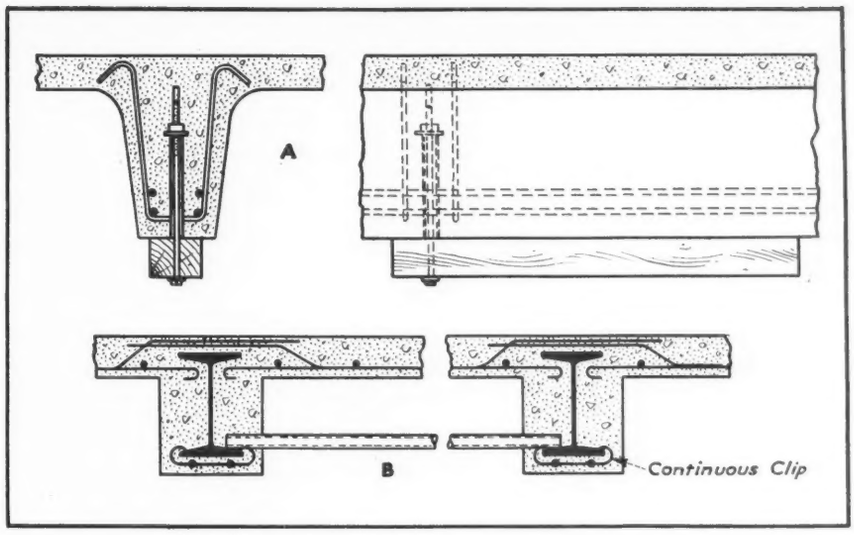


Fig. 2—Typical methods for supporting pipe hangers to give maximum adjustment

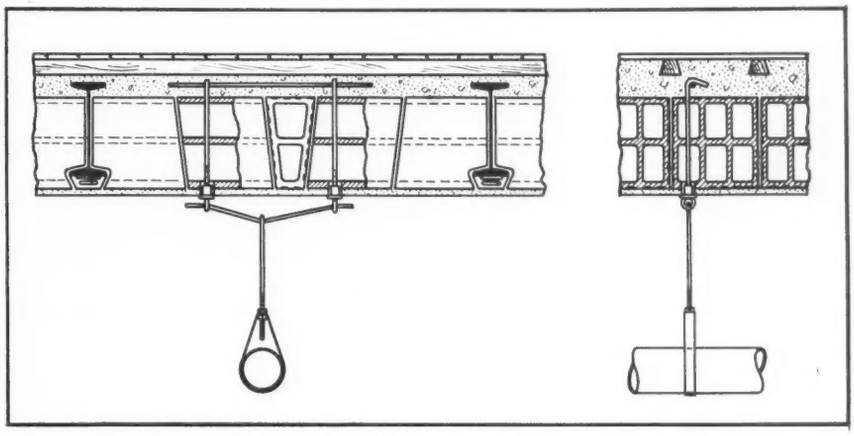


Fig. 3—Tile ceiling construction with heavy pipeline supported from concrete mat

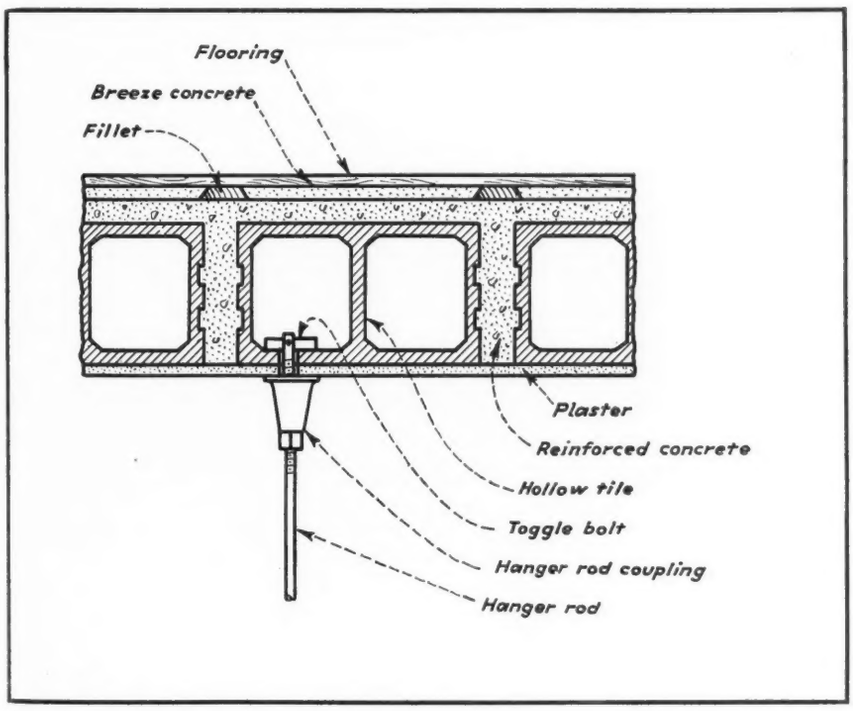


Fig. 4—Toggle-bolt hanger insert used on tile construction for pipes under 2 in.

For a hollow-tile fire-protected steel-beam floor it is even more important to arrange the inserts in pairs since the tiles cannot always be drilled in the particular spot the pipeline happens to be. In Fig. 3, the rods inserted in drilled holes in the tiles are concreted on top of the tiles. They do not project from the ceiling and eyelets are screwed to them from which the pipe is hung by means of crossbar, screw rod and a wrought band.

For light loads, that is for pipes up to 2 in. nominal size, toggle bolts can be used as in Fig. 4. They can be introduced through drilled holes in the tiles.

If the floor is reinforced-concrete-slab, fire-protected steel-beam construction, Fig. 2*B*, it is sometimes possible, if the spacing of the beams is not too

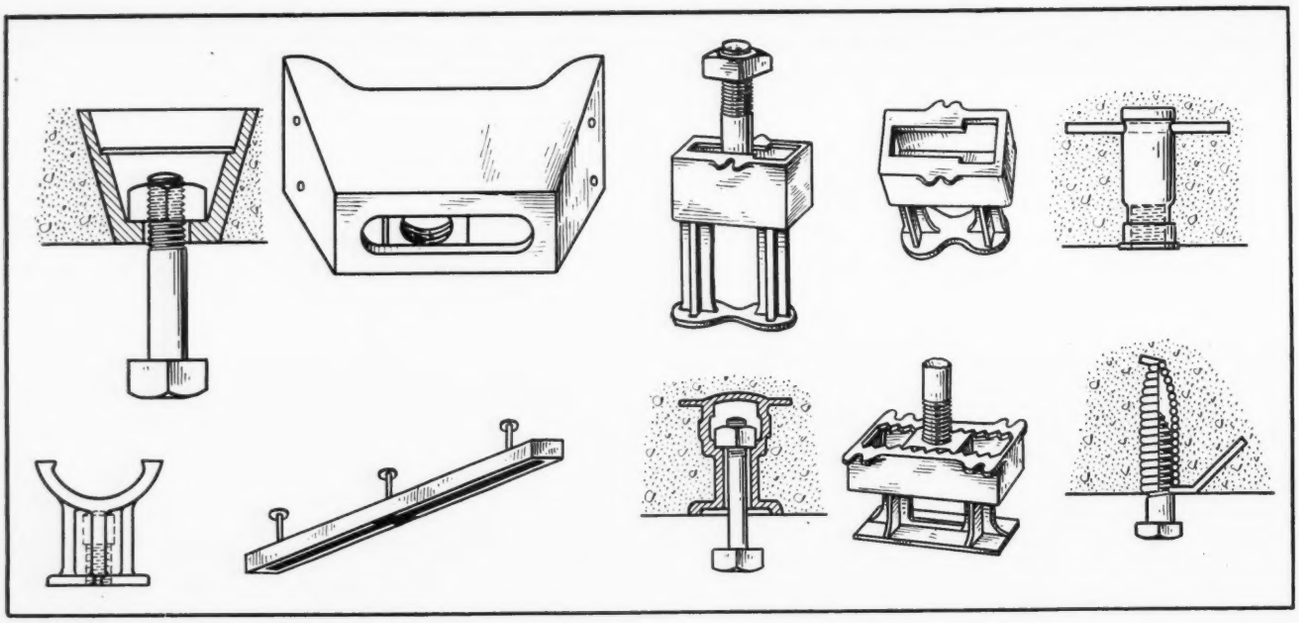


Fig. 5—Hanger inserts for reinforced-concrete construction that can be fastened to the formwork before pouring the concrete

great, to put a steel pipe or crossbar between them supported on the lower flange of the I-beams. This method of hanging pipes from a crossbar provides lateral adjustment and may be one of the best means when several pipelines must be put close together.

If the floor is of structural-steel, either of steel beam and girder type or of open-web steel-joist construction, the problem is reduced to one of making connections to the steel structure.

Flush-Mount The Inserts

The girderless or flat-slab floor, characterized by supporting flared-column heads, is best provided with any of the considerable number of commercially manufactured inserts, some of which are shown in Fig. 5. As a general rule, threads embedded in concrete as in Fig. 2*A* are bad, because they cannot be replaced when damaged, or worn.

Three points may be set forth which a good insert should embody. Threaded parts should be exchangeable, the insert should not project from ceilings or walls or otherwise be unsightly when not in use, and should allow abundant lateral adjustment to the pipeline. This third point can be obviated by arranging the inserts in pairs, which may be less expensive because simple inserts can then be used. Some of the inserts shown are recessed; others are provided with holes to receive reinforcing rods. A better distribution of the load is thereby effected.

Brackets for the support of pipelines must, like hangers, allow for sufficient vertical as well as lateral adjustment. They are generally shown bolted to a brick wall with the bolts extending through the wall and having a backplate on the opposite side of the wall to distribute the load. In practice, however, it is not always so simple. A wall usually has, on the outside of the building, a pilaster projecting a few inches from it. On the inside of the building there are columns jutting out from the wall which would interfere with the pipe line if the brackets were bolted to the wall. Moreover, brackets are used for heavy loads, well over 5 tons. A wall is not always strong enough to take such loads, quite aside from possible vibrations. The natural part of a building to fasten brackets to are the columns. If the columns are of reinforced concrete they cannot, certainly should not, be drilled for bolts. On an already existing building there is always the possibility of clamping steel parts or, in the case of a round column, of placing bands around the column to which the brackets can be fastened.

The whole design of the bracket support should be such that a considerable misplacement of the anchorage does not matter. In other words, provision must be made for generous vertical adjustment to take care ot such misplacement. If that is done there only remains the accurate setting of the anchor bolts relative to each other. The easiest and surest way to accomplish that is to connect them by tack-welded steel rods and bars and give them proper diagonal bracing before placing them in the formwork. A checkup can then be made as to the accurate location of the bolts relative to each other and, if necessary, corrections can be made before the concrete is poured. Fig. 6 shows such a welded anchorage unit for heavy brackets with six bolts.

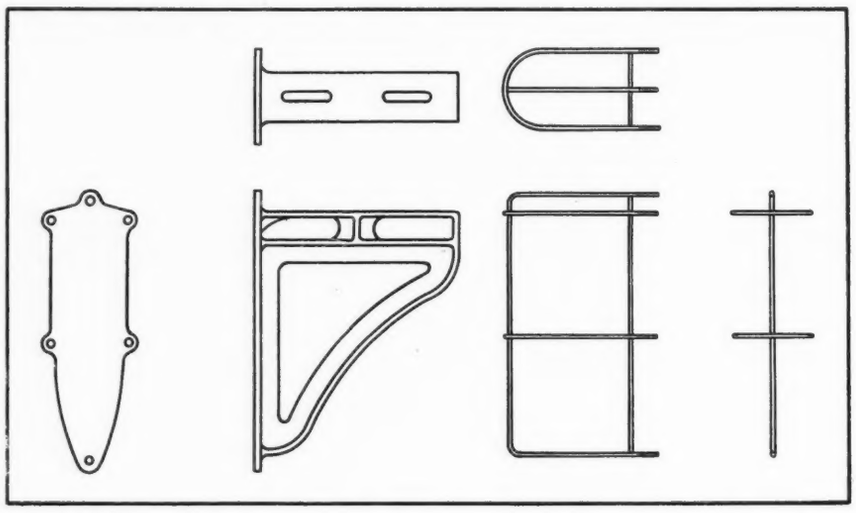


Fig. 6—Wall brackets used for heavy loads or where overhead support is objectionable

Machines Must Work for War—Or SCRAP!

America, at war, sweeping with a new broom, uncovers fresh material deposits which, although in plain view, often are so easily overlooked. E B Robinson, Rochester Gas and Electric Corp, found 2150 tons of scrap by a thorough and systematic survey of equipment

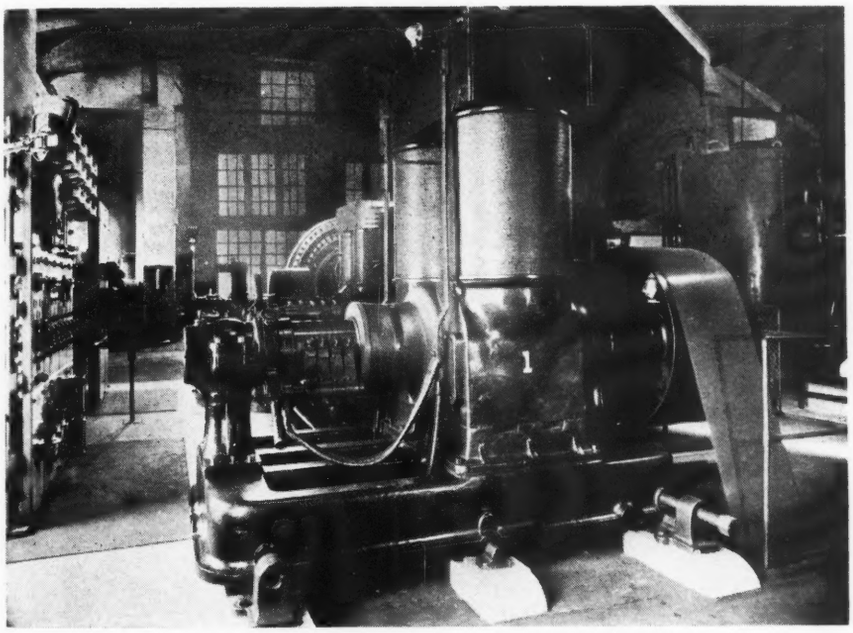


Fig. 1—Although still active, machines such as these will produce greater results when they are converted into equipment which better fits present war needs

NOT TOO LITTLE – NOT TOO LATE

The salvage drive brought in 14,000,000 tons of iron and steel scrap in the first half of 1942. It was a good job well done. But production is going up—and up—and up. Steel men say they must have 17,000,000 tons on the way to mills before the year ends or open hearth furnaces will go hungry. Now is no time to relax the search for scrap. For every pound already turned in, extra sources must develop two pounds to make up for the easy ones that were grabbed up first. Dig deeper boys, it's the follow through that wins wars as well as ball games. Some mills are down to a two-weeks supply of scrap. If you did collect a large amount, don't rest on your laurels, but concentrate on turning in at least as much this fall.

▶ WE HAVE THROWN the proverb, "Save it, you may need it sometime" into the discard. In the past it was only a matter of dollars and cents and quite often the material was considered too valuable to turn into scrap. We now have one purpose: to get all the scrap and get it as quickly as possible. During the first half of 1942 we gathered over 1000 tons of iron and steel. In addition we furnished 72 tons of copper and other non-ferrous metals. Our program is getting results, and by the end of this year we will have contributed for war 2000 tons of steel and 150 tons of non-ferrous metals.

Our former practice in regard to obsolete equipment was to offer for sale machinery that had been retired because of age or capacity. If no buyer was found the machine eventually reached the scrap pile. Operating and construction materials such as line hardware, pipe, valves and fittings were periodically checked to cull out obsolete or slow-moving parts. If no use was found for these items and they could not be sold or returned to the manufacturer for credit they were finally dumped on the plant scrap pile.

We found this program satisfactory for our previous requirements. It allowed us to build up a considerable volume of spare parts, and reduced the scrap, or what we considered waste, to an absolute minimum. In determining material to be scrapped our hoarding instinct affects the decisions; we are prone to look too far into the future trying to find a use for many pieces of equipment. A certain amount of affection is held for machinery which normally keeps it from the scrap heap; small objects such as brass or chromium-plated nuts make nice paper weights, broken pieces of machines, after being brought into the office for inspection, accumulate until housecleaning time, and even then they are sometimes rescued from the cleaning squad and restored to the collection.

Feeling that we should concentrate on collecting scrap, we started early this year to recover every possible piece of scrap and put it in circulation for war production. Our first step was to make a survey of all existing structures, equipment, spare parts, materials and supplies, in fact, every item of plant property not in use.

Like most other organizations, we had equipment and machines we considered as spares with a remote chance that they would ever be used, Fig. 1. We found that certain plants and structures could be dismantled. Our main object being to obtain scrap, cost was not considered, as we felt that the copper and steel had more than a money value as scrap.

A survey of plant equipment should be conducted with several points in mind: Can the equipment be put to any immediate use? Are too many of the same articles retained as spares? If a piece is damaged, can it be repaired, thereby reducing the manufacturer's burden of delivering new parts?

It isn't good wartime sense to hang onto a piece of obsolete equipment when it's probable that it won't ever be used, and the material could be put to immediate use by some other plant. A realistic appraisal of present or reasonable future needs will allow release of considerable equipment to places where it is urgently needed.

Every decision must be made in the cold-blooded light of how the action ties in with the war program. We can't fight the war on unused reserves or with equipment standing idle for sentimental reasons. Worn coal-mill balls make ornamental lawn borders but will be more useful if they are converted into material for our fighting forces.

Heavy Pieces Add Up Fast

Our largest single source of iron and steel scrap so far has been the vertical retort house at our West Gas Works. This equipment has not been in use for a number of years and was not removed, as the cost was considered prohibitive. The dismantling was started several months ago and is now one-third completed. We expect to recover a total of at least 1200 tons of iron and steel from this plant.

The recovering job has been rather difficult, as the retorts are housed in a steel enclosure about four stories high. It was impossible to remove the structure itself because a coal conveyor system operates over the top of the building. It was therefore necessary to remove the equipment and leave sufficient strength in the structure to support this conveying equipment. The work was done under constant supervision and local contractors were used to supply the labor and welders. The scrap was removed and cut, lowered to the ground by hoists, and loaded directly into trucks. The various groups of scrap were segregated into heavy steel, light steel, cast iron, and consisted of structural bars, plates, sheets, valves, pipe, and castings.

From our No. 4 station we secured a total of 413,000 lb of iron and steel and 10,200 lb of copper. The job consisted of dismantling waterwheels, penstocks, generators and auxiliary equipment. Here again, conditions were dangerous and the work had to be well supervised. Because the plant was in the center of the city the scrap had to be elevated from the lower levels to the street and removed immediately.

Miscellaneous scrapped items yielded worth-while quantities of material. From a 2000-kw power transformer we got 10,200 lb of steel and 1500 lb of copper; several obsolete rotary converters yielded 170,000 lb of iron and steel, together with 17,000 lb of copper. Other items included pumps, gas boosters, old street lighting fixtures, ornamental poles and even a trenching machine. Much equipment, including several rotary converters, was sold where it could be put into service.

Idle Equipment Is Scrap

Under peacetime conditions, scrap is usually considered to be only the odds and ends and broken parts of machinery that cannot be repaired. Today any machine, beam or other piece of equipment, whether it is fabricated or not, that is not doing a useful job must be scrapped. If you can't use it, find some one who can or send it to the scrap heap. Check over all existing pipelines, remove what you don't need and straighten out the rest: discard the unused sections and sufficient idle valves and fittings will be found to meet your needs for a long time; other parts can be scrapped.

Stockroom shelves will produce lots of spare parts that have not been used since they were bought. Consult the manufacturer; perhaps they can take them back or tell you where they are needed. Filing cabinets are a source of scrap paper; old meter charts that have been hoarded since the plant was placed in operation will swell the bulk of reclaimed paper.

At our station No. 3 we collected 9000 lb of rubber, including that which the employees brought from their homes. Scrap rubber sources are automobile mats, ash-tray rims, tires and fire hose cut and used for bumpers on barges and landing floats, chair pads, and extra switchboard mats as well as old tires and hose.

Inspect All Equipment

This is also a good time to repair your rubber hose, cut out the bad sections and install connectors. Check over the supply of boots and rubber equipment. Repair these articles by vulcanizing if it can be done in such manner as to retain the full safety requirements. Don't throw rubber articles away if they are needed for useful purposes unless repairing them is impossible. No benefit can be derived from scrapping if the article scrapped must be replaced immediately by making a new purchase.

A scrap program is not efficient unless the salvage angle is considered. If scrapping an article that can be fixed is going to place a heavier burden on the replacement manufacturer, then the thing to do is to put it in usable condition. We salvaged for active-material stock all lengths of copper wire over 20 ft by splicing with a sleeve joint. Shorter pieces, or wire with damaged insulation, are scrapped. All cable passes through the reclamation department for cleaning, inspection, and repairs. Wiped joints from condemned sections are cut out and the solder reclaimed. Scrap cable is then sold as such.

When lead-sheath rubber-insulated cable is scrapped the lead and rubber

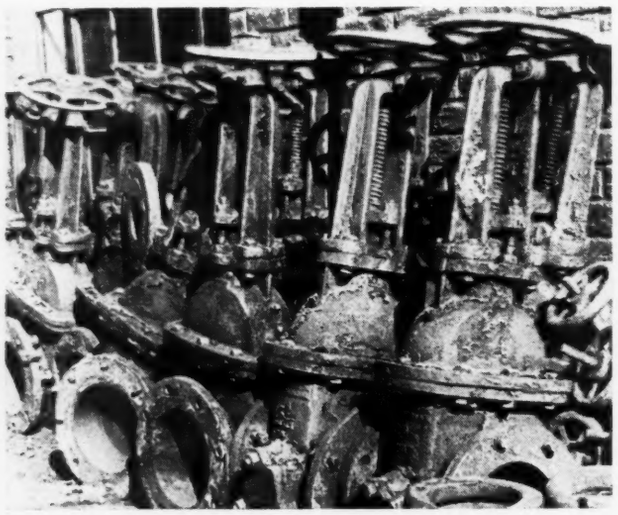


Fig. 2—Valves may be needed by other plants. List with salvage committees if they can be repaired, otherwise scrap them

Fig. 3—The first scrap rubber drive will produce results in a short time; keep the drive active even if returns grow smaller

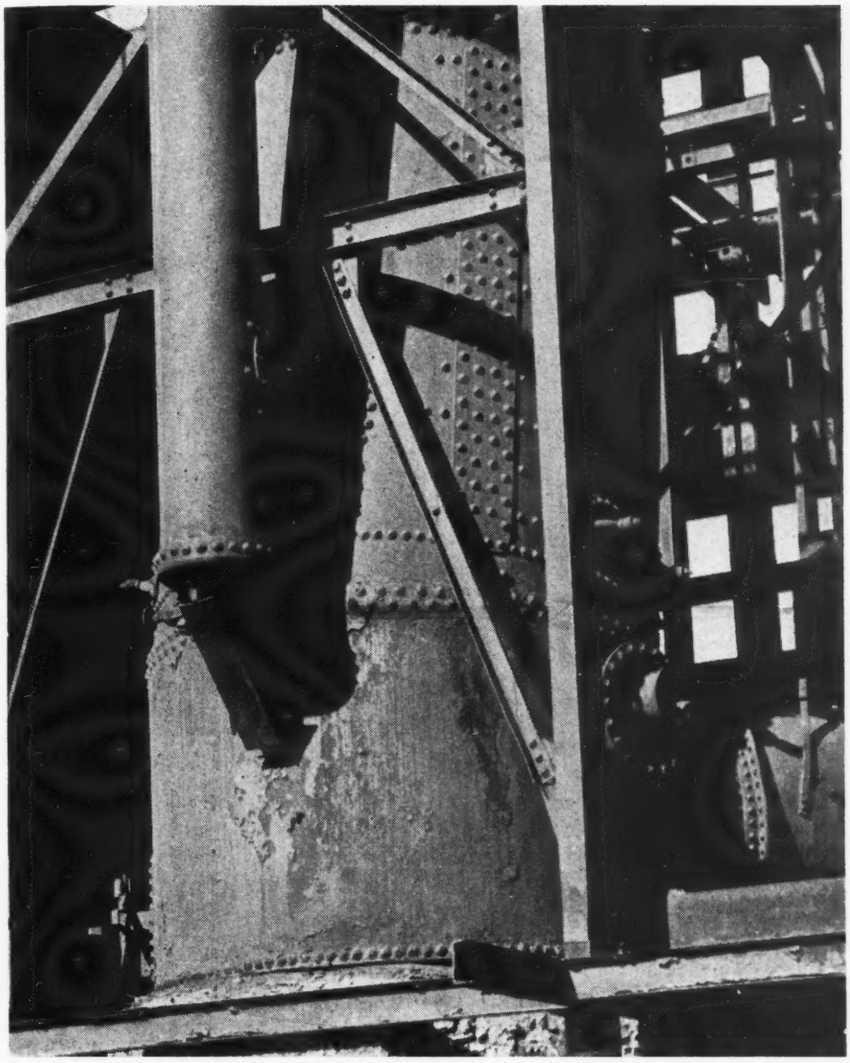


Fig. 4—Obsolete equipment which has been allowed to stand because of high dismantling cost must now come down and join the steel army of fighting equipment

should be stripped from the conductor and scrapped separately.

We completely overhauled all distribution transformers temporarily out of service. We cleaned the oil, cleaned and painted the cases and installed new coil leads where necessary. Burned out coils were rewound or the tanks were used for good coil assemblies from damaged tanks. Scrap transformers were turned over to manufacturers as part payment on new units.

Electric meter parts such as disks, jewels, registers, and screws are salvaged from condemned meters. Weak meter magnets should not be consigned to the common scrap heap as many of them contain valuable alloys. Asbestos from old covering is reclaimed by running it through a special grinding machine which shreds the material. It can then be used as insulation on flanges, fittings and flat surfaces.

Wiping rags are saved, sorted and sent to a local laundry for cleaning. Waste paper is baled, and fiber cartons opened, laid flat, and bound into bundles with wire.

Non-ferrous metal scrap returned from the field to our main storehouse is sorted into different grades and disposed of monthly. Each plant collects iron and steel scrap, separates and sells it. Quite often we salvage short pieces of pipe and make them into serviceable nipples.

Program Results

From January 1 to July 31 we sold 2,105,000 lb of iron and steel and 145,000 lb of copper and other non-ferrous metals. These figures reflect results of the special campaign and also include scrap which we consider normal recovery. However, we feel that 90 percent of the iron and steel and 70 percent of the copper were secured through our special effort.

With the retort house completely dismantled, and with other recovery work now in progress we expect that by the year's end we will have obtained 4,000,000 lb of iron and steel and 300,000 lb of copper.

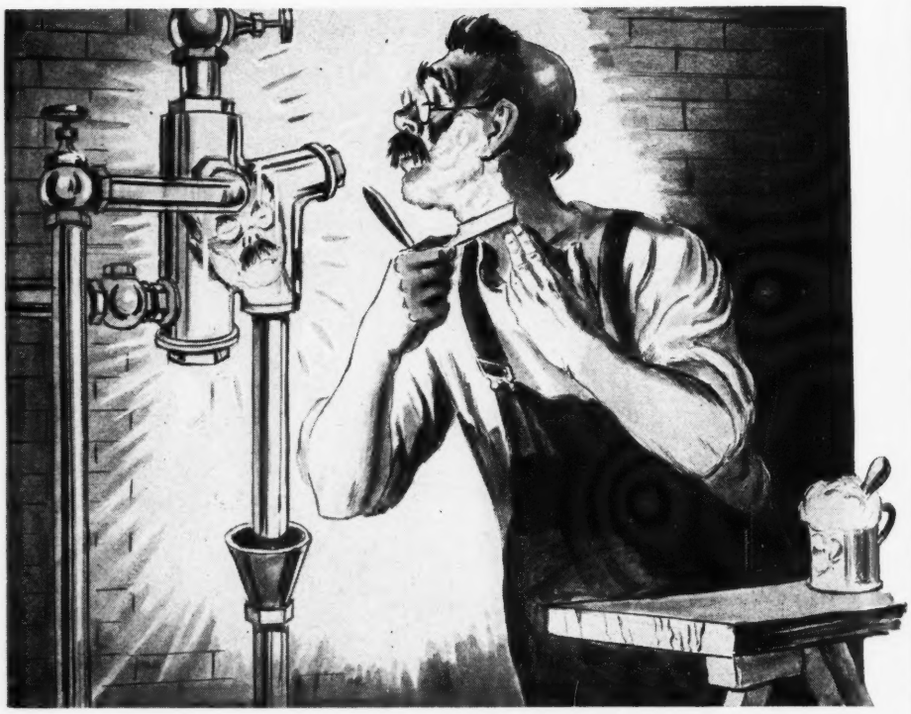
Fig. 5—Survey your piping; many unusual lines will supply tons of scrap metal and removal will improve operating conditions

Fig. 6—Tearing down obsolete plant sections releases considerable material for other plants and provides vast amounts of scrap

The Old Chief

23—Mistakes

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the past, he has captured much of the human side of engineering behind the many wavy lines on paper disks



"... and the standby injector was bright enough to shave at."

▶ YOU HAVE PROBABLY NOTICED that elderly men are sometimes guilty of repeating stories, anecdotes and experiences to which you have listened many times. This habit, while unpardonable in a young man, is the unquestioned privilege of all septuagenarians. Many of the Old Chief's observations and experiences would not have been remembered today had it not been for his habit of telling "twice-told tales."

For instance, I have often heard him express himself on the general subject of mistakes. Grievous mistakes involving danger to life and property, and small mistakes of judgment and omission that sometimes forfeited a man's right to the reputation of dependability. The Old Chief admitted that he had made many mistakes and hoped he had profited by them. He stated that he had judged both men and metals wrongly at times and as long as he continued to do things he expected to make mistakes.

The Great John Gast

This subject would invariably bring up the story of the great John Gast, who before my time was the chief of a boiler plant in Michigan. I have taken the liberty of changing his surname but I assure you that his real name was a legend among stationary engineers when I started to work with the Old Chief.

John Gast had more brass under polish in his engine room and boiler room than had any other plant in the county, and his polish was the brightest. Even the valve handles on the feed manifold were solid brass, and the standby injector was bright enough to shave at. The set wrenches and pipe wrenches on their white enameled panels resembled the manufacturers' display sets you might see in store windows.

John Gast's plant was a yardstick by which ordinary humans might gage their ability to manage a power plant. The steam whistle in most places was operated by a length of flexible wire extending through the roof. The whistle that called John Gast's factory to work was brought to life through electroplated rods actuated by an electroplated spring-tensioned lever, in turn mounted on a heavy brass plaque which had the firm's name etched in a florid scroll.

The Fly in the Ointment

John Gast's plant was a helper's nightmare and the envy of every chief in the town. His only trouble, strange to say, was a rather unusual one. His safety valves had plagued him since they were installed. On a lift test, they often stuck and after the test leaked or chattered. Twice he returned them to the makers without any improvement.

Finally, five new safety valves of a new and improved type were delivered to him and he laid plans to improve on the original relief pipe layout. The job as the Old Chief described it was up to John's reputation for neatness and alignment, a perfect example of pipe fitting, but unfortunately, *a horrible example of steamfitting.* The great man had made no provision for expansion or checking and had not provided a single drip in the whole assembly. When he made his first test, he nearly brought the plant down around his ears.

And so with this one big mistake off his chest, John Gast slipped over his pedestal and became an ordinary dunce engineer like all the rest of us.

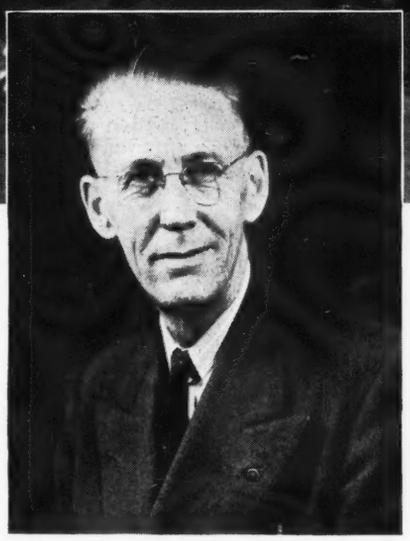
Then there was the story of the man who was preparing a boiler for inspection. He sent his fireman back to empty the boiler while he went for dinner. When he came back he found that the fireman had opened the wrong blowdown. The result was a six-week job for the boiler maker.

Air Abhors a Vacuum

Speaking of opening up boilers, the Old Chief told me of a marine boiler that was emptied under low pressure in an Eastern port. The blowdown was promptly closed at the right moment to prevent the re-entry of sea water. Unfortunately, through a misunderstanding or neglect, *no one had vented the boiler*, and as a result when a young Eurasian dock worker opened the top manhole he was promptly sucked into the boiler and killed.

"I have known mistakes," the Old Chief mused, "to be made by automatic devices, let alone human. But the most awful mistake I ever made was on the payday I walked home in the snow and forgot to call at the office for my check."

When war loomed the engineers of the Santa Barbara Naval Reserve crowded the garage plant to learn about steam by seeing and doing. Thus Banks' boyhood dream and grownup hobby of steam engineering went to work for Uncle Sam. Today many of these boys are in the Navy and Merchant Marine, helping to keep steam up



His business is typewriters, but A E Banks filled his garage full of steam machinery and hooked it up for practical action

His Hobby Helped the Navy

When A E Banks began to collect discarded steam machinery as a hobby, he had no notion that he might be doing his bit in a future war with Germany and Japan. But he was; the unique assortment of steam units in Bank's garage at San Roque Park, Santa Barbara, Calif., has already finished one job of training for seagoing engineers and is standing by for further orders.

That school ran back in 1941, before Pearl Harbor. Twice a week 33 members of the engineer force of the local Naval Reserve assembled in the garage to learn about steam first hand. Everything was hooked up and in working order—boilers, oil burners, feedwater heaters, injectors, feed pumps, superheaters, horizontal and vertical engines, steam turbines, motors, generators, condensers — also uncounted lubricators, valves, traps and gages.

A superficial observer might have thought that this gadgeteer's paradise, full of antiquated equipment, could have little value for engineering instruction, but Banks knew better. He knew that to learn about practical steam engineering you had to take equipment apart and put it together again—and that ancient equipment was just about as good as modern for this purpose.

Strange to say, the builder of this plant has never worked for a living at steam engineering. It's just a hobby with him—boyhood's dream come true.

Born in Delmar, Iowa, the boy Banks knew early that he wanted to be an engineer because the Chicago-Milwaukee and St. Paul R R ran through his back yard. The locomotives fascinated him.

As a youth he enlisted in the Navy. Working up to chief radioman, after World War I, he took a course in radio and Morse Code, passed U. S. Government First-Class Commercial License and Civil Service tests. With this back-

(*Continued on page* 100)

Consistent development of Riley Pulverizers

Before purchasing pulverizers

CHECK ✓ *these important operating characteristics*

Pulverizers should be purchased on the basis of the proper evaluation of each of the many following operating characteristics—not on the basis of any one characteristic.

✓ FLEXIBILITY—WIDE LOAD RANGE

Because a change in rate of coal feed gives an instantaneous change in coal output and because a comparatively small amount of primary air is required for proper pulverizer performance, widely fluctuating loads are easily carried. Load ranges greater than 10 to 1 are carried satisfactorily at many Riley installations.

✓ SUSTAINED FINENESS OF PULVERIZATION

Due to recent developments wear of the various pulverizing elements has a balancing effect upon fineness of pulverization with the result that fineness is maintained throughout the life of the pulverizing elements. Fineness readings plotted against tonnage pulverized gives a straight line curve. No adjustment to pulverizer is required as parts wear.

✓ MAINTENANCE

Changes in design and materials utilized has resulted in over a 300% increase in life of pulverizer parts. This means greater continuity of operation.

✓ EASE OF PART REPLACEMENTS

It is easy and simple to make part replacements, requiring but short outage for repairs. Complete overhaul of a 24,000 lbs. per hour Riley Pulverizer can be made within seven to eight hours.

✓ EASE OF LUBRICATION—BEARING LOCATION

All bearings used with Riley Pulverizers are located outside and independent of the pulverizer housing where they are readily accessible. Oiling is required but once daily. There are no seals that require grease from pressure guns.

✓ EXPLOSION HAZARD

There has never been an explosion in a Riley Pulverizer. Because of design features there can be no explosion in a Riley Pulverizer.

✓ POWER CONSUMPTION

Recent developments have materially reduced the power consumption of Riley Pulverizers at maximum loads. The power consumption of Riley Pulverizers at low loads has always been low because of low no load power.

✓ FINENESS OF PULVERIZATION

Changes in design have brought about increased fineness without increase in power consumption, very high percentage, over 99%, of the total coal passing through a 50 mesh screen.

✓ EASE OF CONTROL AND OPERATION

Only secondary air and coal feed need be varied to meet load variations. No other adjustments are necessary. This greatly simplifies operation and application of combustion control.

✓ RELIABILITY

The more rugged construction of the new Riley Pulverizer assures even greater reliability. Plant after plant has operated Riley Pulverizers for years without outages because of mill performance. The speed with which repairs can be made also increases operating availability.

✓ COST OF INSTALLATION—SPACE REQUIRED

The design of Riley Pulverizers is very compact, requiring comparatively small space for installation. Due to vibrationless operation massive extensive foundations are not required.

✓ ABILITY TO CARRY LOW LOAD

Because pulverization is satisfactory when only about ten per cent of the air required for combustion is supplied as primary air, low loads can be carried with Riley Pulverizers.

✓ LIMIT OF PREHEATED AIR TEMPERATURES

Preheated air regardless of temperature can be used without tempering. There is no necessity for reducing air temperatures as a precaution against explosion or fire. Air temperatures above 600 degrees can and are being used with entirely satisfactory results.

✓ QUIET VIBRATIONLESS OPERATION

It is generally conceded and recognized that the Riley Pulverizer is the most quiet pulverizer manufactured—you merely hear the hum of the pulverizer motor. At all loads, including low loads or no load, Riley Pulverizers give quiet vibrationless operation.

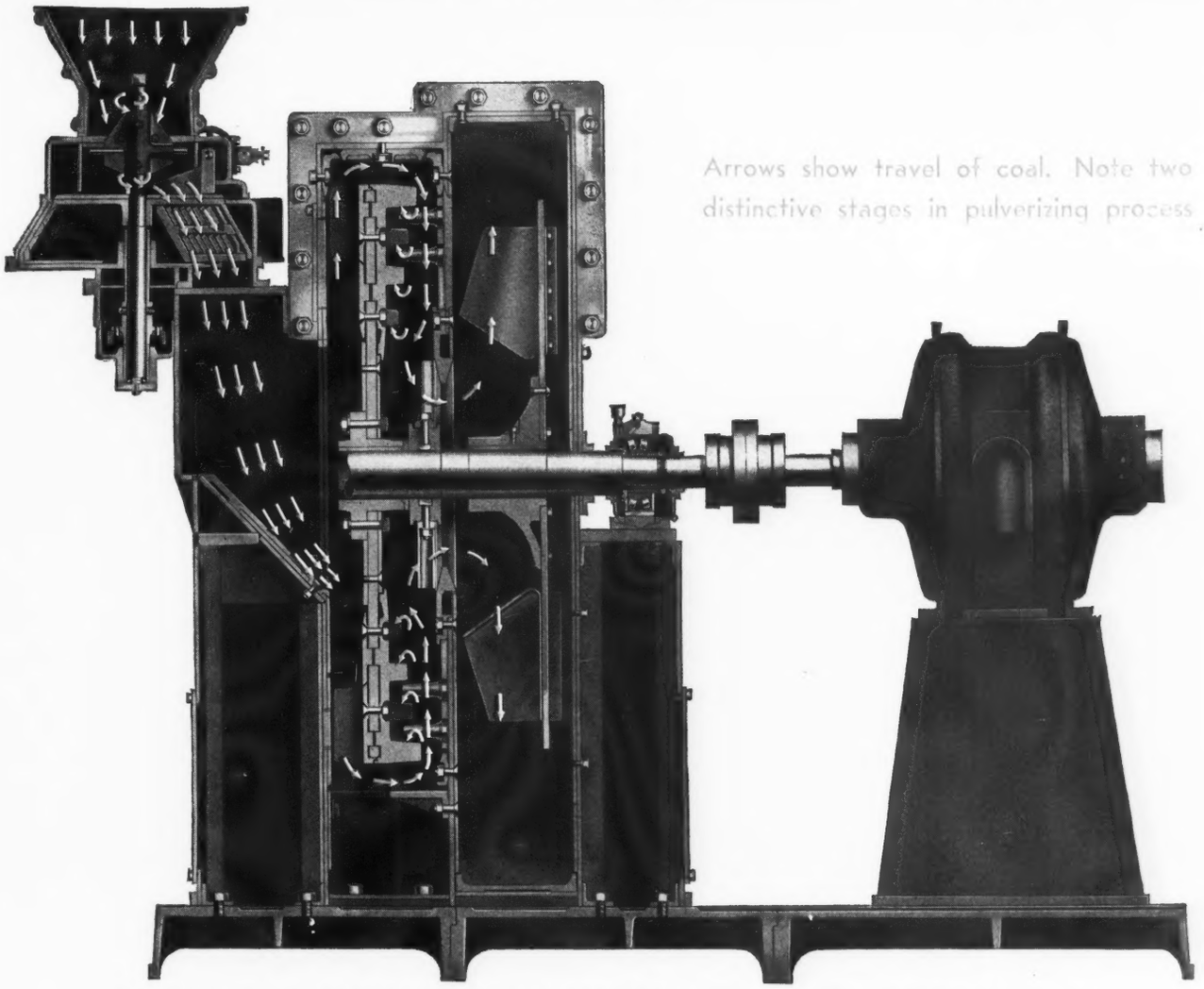
RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

has resulted in vastly improved Performance



Arrows show travel of coal. Note two distinctive stages in pulverizing process

CROSS SECTIONAL VIEW IMPROVED RILEY PULVERIZERS

A Few Prominent Users of Riley Pulverizers

*Union Electric Co. of Illinois, Cahokia
*Union Electric Co. of Illinois, Venice
*Union Electric Co. of Missouri, Ashley Street
*Iowa Illinois Gas & Electric Co.
Potomac Electric Power Co.
*Interstate Power Co.
United Electric Illuminating Co.
Hartford Electric Light Co.
Connecticut Power Co.
Edison Electric Illuminating Co.
Lowell Electric Light Co.
Lynn Gas & Electric Co.
*Union Public Service Co.
Carolina Power & Light Co.
*Central Ohio Light & Power Co.
*Oklahoma Gas & Electric Co.
Pennsylvania Edison Co.
*Tenn. Valley Authority
General Electric Co.
Winchester Repeating Arms Co.
Scovill Manufacturing Co.
*Western Cartridge Co.
*Shell Oil Co.
*Standard Oil Co. of Indiana
*Curtiss-Wright Corp.
Celanese Corp. of America
Norton Company
*Kellogg Company
Dow Magnesium Co.
*American Car & Foundry Co.
Standard Oil Co. of N. J.
Worthington Pump & Machinery Co.
Titanium Pigment Co.
Agfa Ansco Corp.
Beechnut Packing Co.
Taylor Instrument Co.
National Cash Register Co.
General Machinery Co.
*Owens Illinois Glass Co.
Carnegie Illinois Steel Co.
Wheeling Steel Co.
Publicker Comm. Alcohol Co.
W. Va. Pulp & Paper Co.
Johns-Manville Co.
Carbide & Carbon Chemical Co.
American Viscose Co.
*Allis-Chalmers Manufacturing Co.
Henry Disston & Sons Co.
Champion Coated Paper Co.
Forstmann Woolen Co.
*City of Springfield, Ill.

*These plants burn low grade mid-western coals.

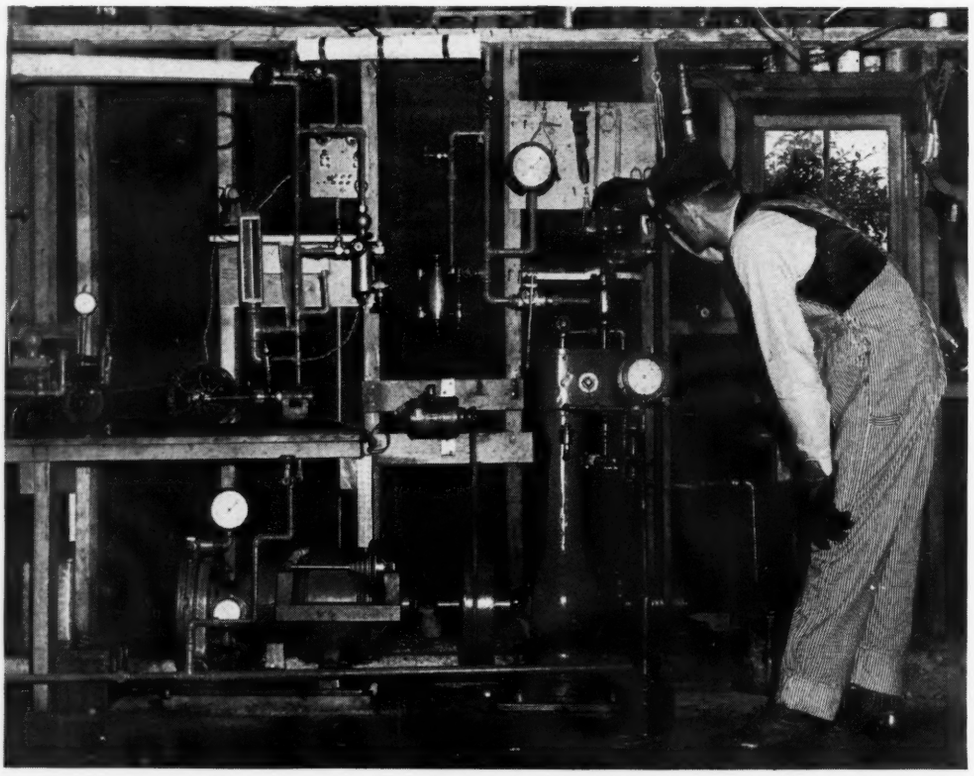
More than 50% of the above companies have placed repeat orders for Riley Pulverizers

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment



Banks traces his love for steam to the locomotives that ran past his boyhood home in Delmar, Iowa. Grown up and settled down in the typewriter and stationery business, he spent years collecting old engines, turbines, pumps and other steam machines. He knows them all — every nut and bolt, for he took every unit apart for study as soon as he bought it. Because everything is hooked up in working order, Banks' plant is a schoolroom and laboratory as well as a playground

(*Continued from page* 97)

ground, strange to say, he went into the typewriter and stationery business in Santa Barbara. But a shore base and an established business gave him a chance to satisfy his life-long curiosity about steam engineering.

Picking up old engines was a tough job, but Banks was patient, like all collectors. He worked the entire Pacific Coast, New Orleans, Chicago, Davenport, Dubuque, Bodie, and Virginia City. He even haunted junk yards and secondhand industrial-equipment shops.

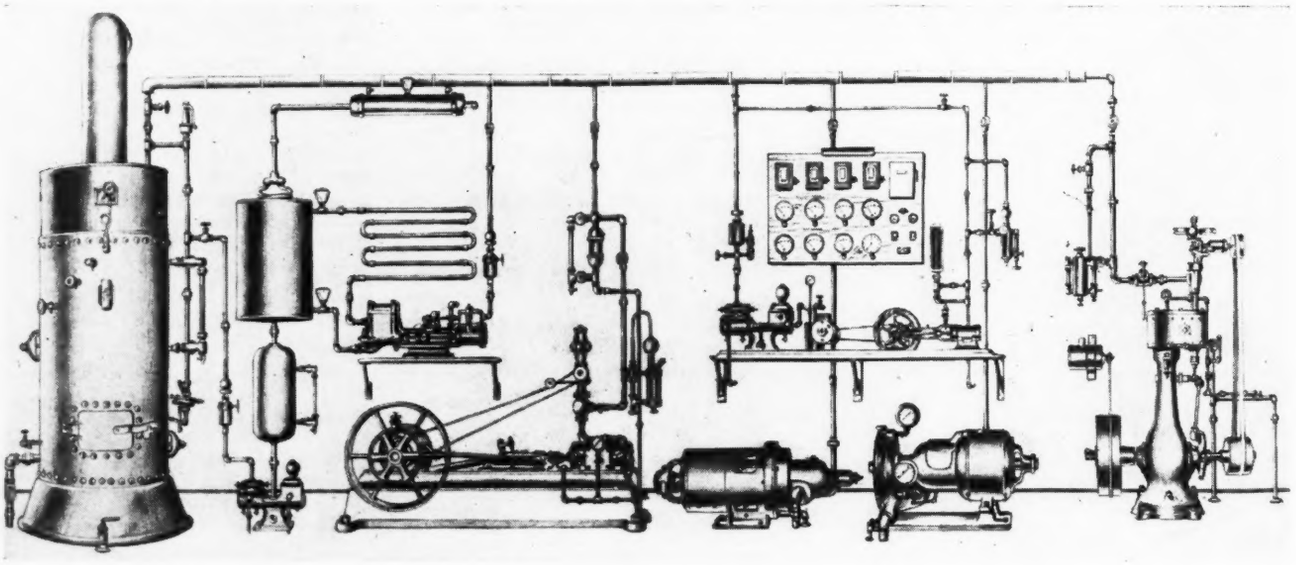
Every time he added a gadget to his collection he took it entirely apart and studied every piece, then read everything he could find about this particular kind of unit. As a result, when the garage power plant was finally assembled, its owner and chief engineer knew every bolt and nut by heart.

What better place to train sea-going engineers for Navy and Merchant Marine? So in 1941 the local Naval Reserve came out twice a week, by special invitation, and the boys took to the "drive-it-yourself" brand of teaching like ducks to water. They tore down pumps, repaired and packed them, set valves. They looked inside turbines to find out what made the wheels go around. They experimented with various sizes of jets and openings. They made indicator diagrams.

All of the engines are hooked up to dc generators, so the boys were able to figure the output in watts. They connected and reconnected engines to run twin and compound—also condensing and non-condensing.

The fellows who took the course in 1941 have long since gone. They sail the seven seas on turbine-driven ships with chrome ladders and white instrument boards. They are in the war, building on the foundation laid by A E Banks in a California garage.

To make this plant a family affair, artist Harlan E Banks, son of A E, produced this free-hand sketch of some of the equipment.



WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Bonding High-Lead Babbitt To Cast Iron

RETURNING FROM VACATION, the editor found on his desk a sizable hunk of cast iron, cleanly coated all over with a well-bonded high-lead alloy. With it were some photographs and microphotographs and a letter from J H Shoemaker, president of Kolene Corporation, Detroit.

Learning of our articles and letters on substitutes for high-tin bearing metals, Mr Shoemaker rightly concluded that we would be interested in his process for bonding low-tin alloys to bearing shells of cast-iron and steel. The following comments are quoted from Mr Shoemaker's letter.

"The 81½-lb main bearing for a diesel engine (Fig. 2) was processed as follows: First, the casting is prepared either by machining or sandblasting unmachined surfaces so as to cut through the surface skin. The cast iron is then immersed in Kolene Kleaner No. 1, a hot bath of molten catalyzed salts at approximately 800 F for five to 15 minutes after the bearing has been brought up to the bath temperature. This bath converts the impurities at the surface of the iron to an easily soluble oxide and at 800 F burns the graphite flakes on the surface.

"When cast iron is exposed to acid of any degree of strength or heat, additional impurities are exposed; therefore,

Fig. 1—Microphotograph (350 diameters magnification as reproduced) shows cast-iron sleeve bearing coated with Kolene Flo-Met'l and then poured centrifugally with high-lead babbitt (1% tin)

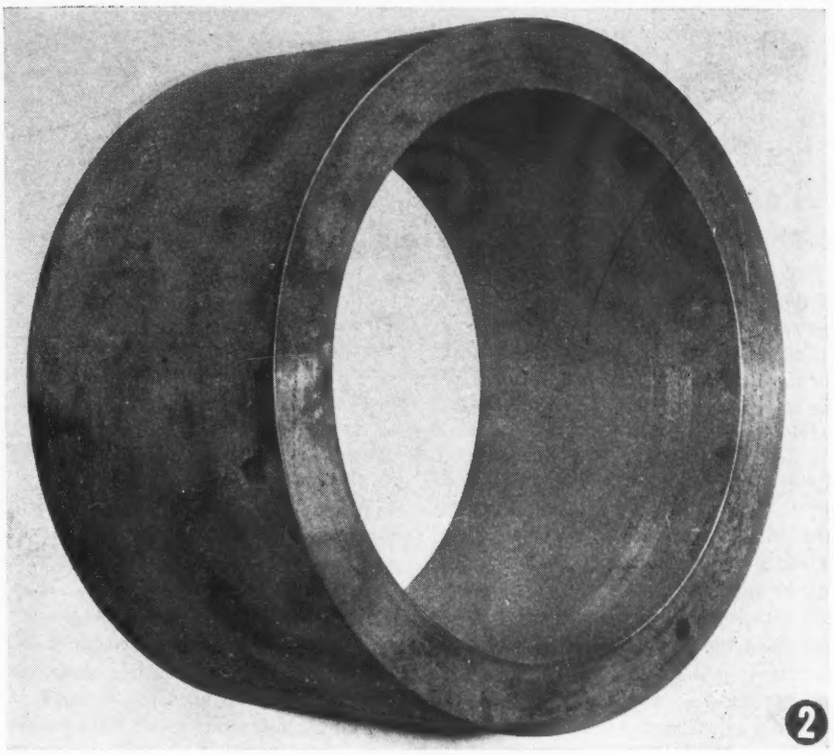


Fig. 2—This 81½-lb cast-iron main bearing shell for a diesel was processed as described

this No. 1 bath is followed by immersion in a second salts bath (water solution) 250 to 290 F. This is a reducing bath which removes the oxides produced by No. 1 bath. This immersion varies from ten to 30 minutes. There are no harmful effects by a longer immersion.

"Both of these baths are followed by water rinses, as the salts of each bath are water soluble.

"The cast-iron part is immersed momentarily in mild, cold hydrochloric acid to remove the alkalinity, and is then immersed in Flo-Met'l through a molten top flux at approximately 657 to 725 F. This time of immersion in the molten metal is varied with the weight and size of the casting in proportion to the volume of molten metal.

"The bearing should be taken from the Flo-Met'l bath while still above the melting temperature of the Flo-Met'l (480 F) and poured before oxides have a chance to form on the surface. In some cases it has been found desirable to use a flux when pouring, but it usually is not necessary.

"Steel-backed bearings are processed in the same manner, except that the second salt reducing bath and following quench is not necessary in coating steel, nor is any pre-sandblasting or machining necessary.

"Shear tests on Flo-Met'l-bonded

TELLING TEMPERATURE BY COLOR (*See page* 102)

Color	Degrees, F
Lowest visible red	885
Lowest red to dark red	885 to 1200
Dark red to cherry red	1200 to 1380
Cherry red to bright cherry red	1380 to 1500
Bright cherry red to orange	1500 to 1650
Orange to yellow	1650 to 2000
Yellow to light yellow	2000 to 2400
Light yellow to white	2400 to 2800
White to dazzling white	2800 or higher

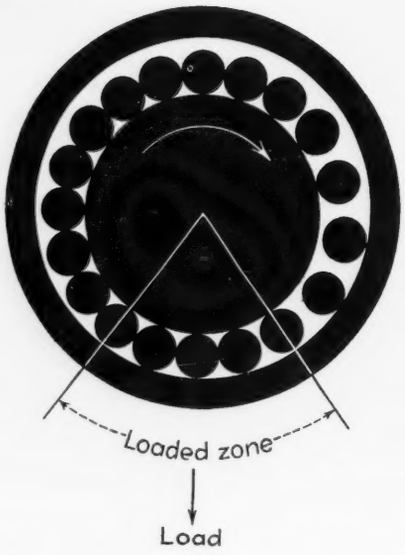
bearings without anchor holes showed approximately 16,000 psi shear strength compared with about 800 psi maximum shear strength on the same bearing with anchor holes. It is our belief that anchor holes or grooves may be eliminated in many, if not all instances, with this bond. The indications are that the metal thus saved will in most instances be sufficient to pay for the bonding process."

More About Cageless Roller Bearings

(The following is a discussion of the letter, "Doesn't Like Cageless Bearings on page 92 of August "Clinic," in which George Holman argued that cageless roller bearings are practically useless for industrial applications because of the manner in which one roller rubs on the next.—Editor)

THE SKETCH SHOWS, in exaggerated form, a cageless roller bearing running under load. The rollers below the shaft in the loaded zone carry the load and roll between the races. Forward speed, and rotation around their axes, of these rollers in the loaded zone is equal and governed by the rotational speed of the inner race.

Rollers leaving the loaded zone push the unloaded rollers, causing them to rub against each other and roll and slide around the races and acquire an unequal spacing. This causes an uneven entrance of the rollers to the loaded zone, where at times they contact each other with pressure. Having equal forward and rotational speeds within the loaded zone, this contact causes no rubbing or sliding, but produces rolling friction between the contacting rollers in the loaded zone.



Clearance between races in the unloaded zone shown exaggerated for clearness

All this is of little consequence if the bearings are intended for light service, as proved by the use of cageless bearings in many industrial applications. Considering heavy-duty bearings, a cage will lower the friction, improve efficiency and increase the life of a roller bearing. Cage or no cage, the most important thing to remember when making your own bearings is that accuracy of dimensions, concentricity and surface finish are just as important in a roller bearing as they are in a ball bearing.

In ball bearings, the "point" contact of ball against ball in the loaded zone develops a high specific pressure in the contact area—necessitating the use of a cage even for light-duty bearings.

Philadelphia, Pa. EMIL WITTMAN

Melting Furnace for Non-Ferrous Metals

THE TWO FURNACE DESIGNS shown are based on my work in wood-distillation plants. We were far from sources of supply for bearings and other small castings of bronze and brass and similar alloys, so we melted our own very successfully in furnaces like these.

The oil-fired unit (Fig. 1) is also suitable for gas firing. Dimensions shown may be increased or decreased for greater or less capacity. This furnace can reach a temperature of 2400 F. Melting points encountered range from 450 F for tin to 1920 F for bronze.

Build the furnace in a dry spot with good ventilation to carry away the poisonous fumes of such alloys as brass. If possible, build it on a 5-in. layer of sand.

For proper operation this type of furnace requires a long luminous flame—soft white or light yellow. Since no suction draft is required, chimney may be omitted if furnace is outdoors.

This furnace has no provision for lengthwise expansion, but has loose lengthwise joints between the arched crown and the sides. Buck staves on the sides must be adjusted as the furnace heats or cools.

After finishing the furnace let it dry out for three or four days, then allow at least 36 hours to fire up the first time. Subsequently heating up may be reduced to six or eight hours. Cooling should be slow; fast cooling may do more harm than fast heating. When cooling, watch the cracks at the expansion joints and adjust the buck staves as necessary.

The furnace shown is 36-in. wide. Charging door opening should be large enough to admit a man to repair and

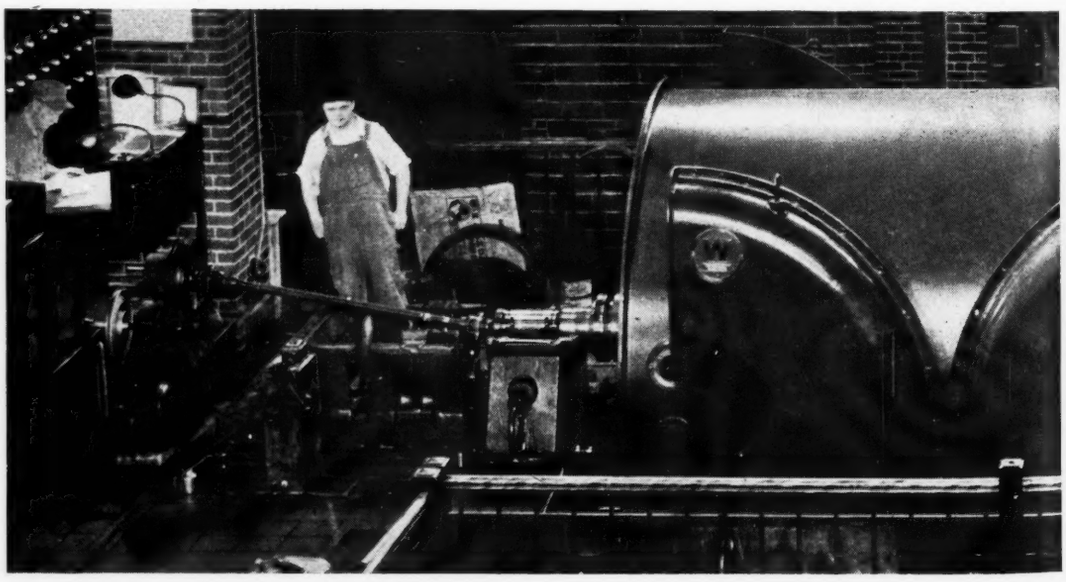


Fig. 1—Group at right watches metallizing. Note the turning mechanism at the left

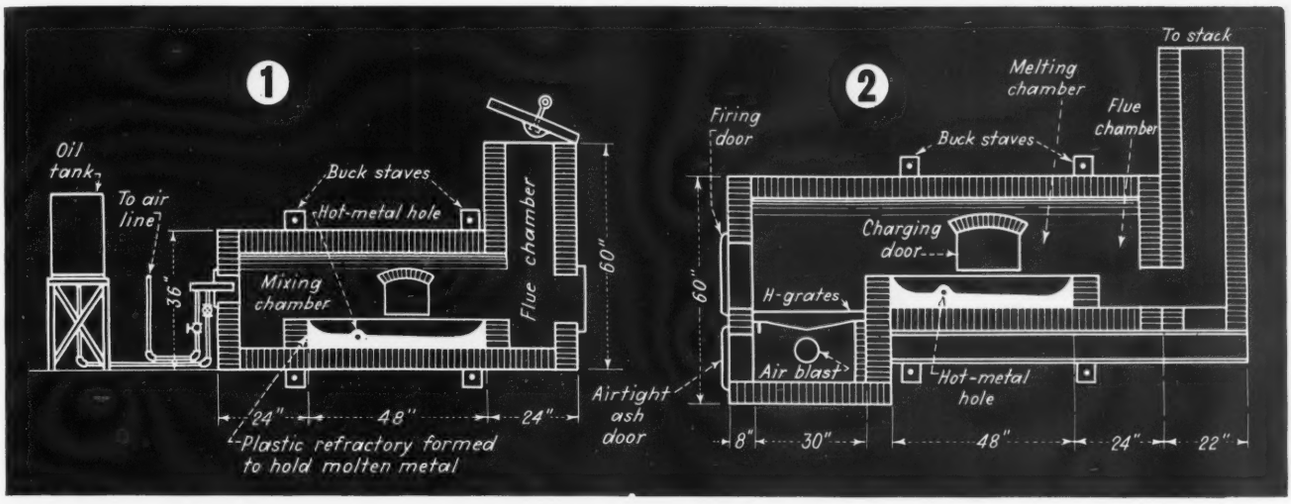


Fig. 1— Oil-fired furnace for a melt of from 200 to 500 lb. Fig. 2—Coal- or coke-fired furnace for a melt of from 200 to 500 lb

clean the furnace. Charging door may be made on the spot with cast refractory. I have used the A P Green Fire Brick products—furnace of K99 fire brick laid up with "Sairset"—"Super-Plastic" for the bottom of the melting chamber—"Kast-Set" for the doors.

The arched top of the furnace is laid on wooden forms, burned out when the furnace is first fired.

The coal- or coke-fired furnace (Fig. 2) is higher and longer than the first to allow room for grate, ash pit and combustion space. Firebox is 30-in. deep to fit standard 30-in. H-type grate bars. Because of forced-draft air blast to ash pit, pit door must be sealed. Melting chamber is same as for gas-fired furnace.

Solid fuel requires a stack. Opening to stack is at lower end of flue chamber, the end wall thus forming a baffle to keep heat in melting chamber and reduce stack temperature.

A 24-in. blower fan will furnish enough air for this tank. Use a damper in the line to regulate the air when starting and stopping.

A good low-ash soft coal is better than coke. Coke will make a much hotter fire, but is much more difficult to regulate at these temperatures and is hard on the grates. To avoid overheating furnace and metal use a thermocouple if possible. Place the couple in the top over the melting chamber, out of the way so it will not be damaged when charging or cleaning the furnace.

The hot-metal hole can be on either side of the furnace as convenient. It is in a tapered spout about 2 in. on the inside and 5 in. on the outside. The plug used is tapered to fit the hole and is sealed with a little fireclay. The cone is attached to a rod at least 24-in. long for safety and convenience.

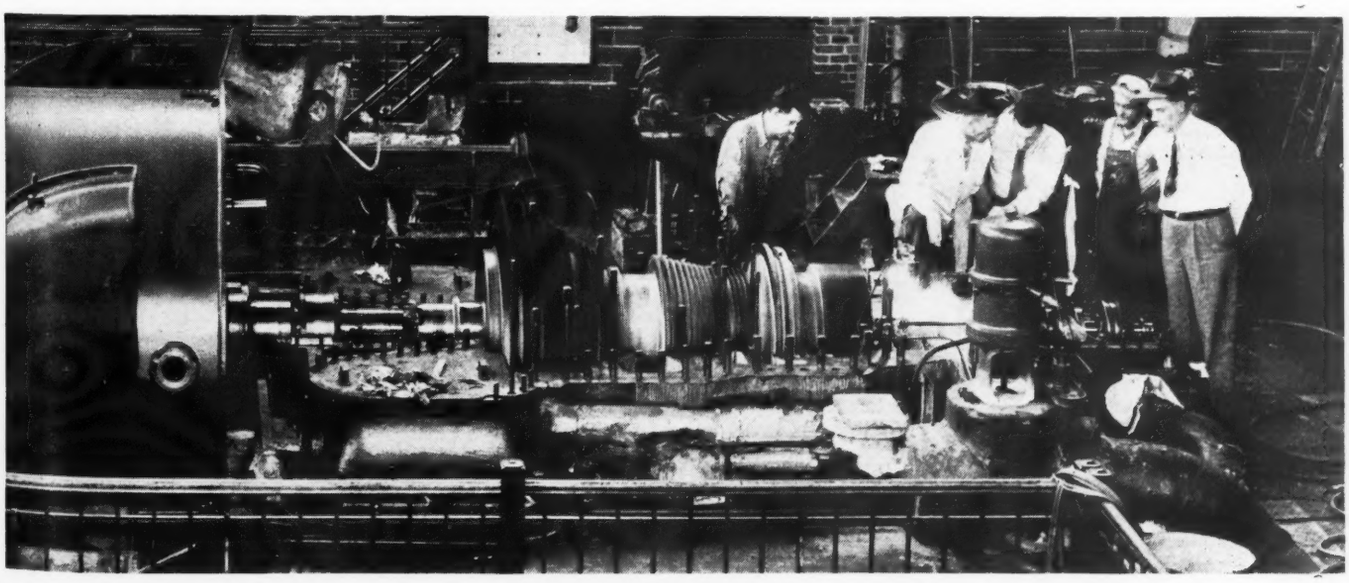
If you have no thermocouple the color table on page 101 will give you an idea of the temperature inside the tank.

Warren, Pa. HARVEY E OSGOOD

Rebuilt Shaft on Turbine

A MIDDLE-WEST POWER COMPANY was recently forced to shut down its 6000-kw steam turbine generator because of a worn shaft. Two areas of wear were noticed in the water-seal section of the shaft; one about 3 in. wide at the 11-in. diameter section of the shaft; another 2 in. wide at 10½-in. diameter.

Using a "portable lathe" type of rig clamped to the turbine bed, the worn sections were first undercut about 3/16 in., then grooved and knurled. This same rig served later to hold the Mogul gun during the metal-spraying operation, which required 40 pounds of No. 2 11-gage stainless-steel wire. Using propane gas, the metallizing and subsequent grinding required only seven hours. Shaft was cooled by an air jet on the back side. A repair of this type saves a lot of money, but reduced outage time is even more important with today's heavy war loads and shortage of



replacement parts. While the turbine was down the engineers examined parts of the shaft that had been similarly metallized three years ago, and found no appreciable wear.

As will be seen from Fig. 2, the shaft-rotating mechanism consisted of a motor V-belted to a large pulley on a reducing gear. This, in turn, drove the shaft at 5 rpm through a motor truck drive shaft with two universal joints.

Other wartime uses of metallizing include the reclaiming of water-turbine runners, pump shafts, steel pins, gate assemblies and stuffing boxes. Chrome wire is satisfactory for all of these.

Chicago, Ill. E T PARKINSON
General Manager
Metallizing Company of America

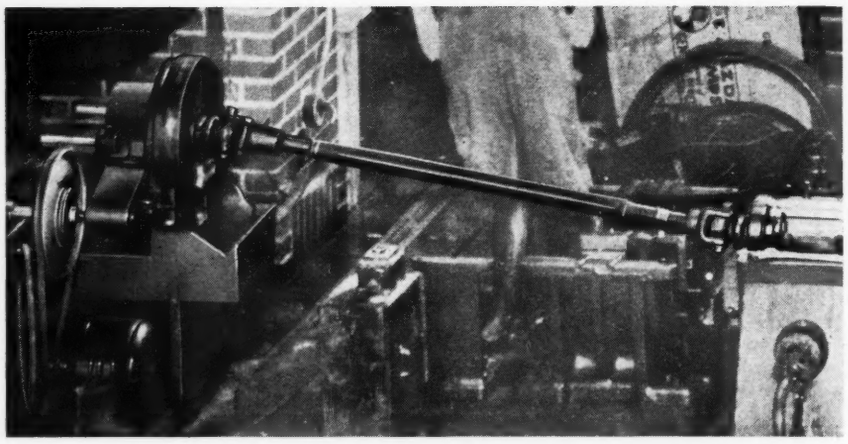


Fig. 2—Shaft-rotating mechanism is motor V-belted to large sheave of reducing gear which turns turbine through truck drive shaft with universal joints

Quick Changeover of Large Piping

WRITING IN A RECENT ISSUE of *Valve World*, Wm F Cox, of Crane's Kansas City branch, tells how he planned a quick changeover of large piping for a paper mill.

To make room for a new generator the 12-in. riser shown in Fig. 1 had to be moved. As originally planned the change would have required two days, during which the mill would be shut down. "Right now," said the mill engineer, "that's almost a disaster".

He continued, "We plan to move this 12-in. riser about 6 ft from where it is now and connect it back into the same 12-in. horizontal overhead header. To shift the riser we must offset the 12-in. horizontal line running under the floor and connecting into the base ell of the riser. The connection back into the header presents our greatest difficulty, as the header under the new location of the riser is only 8 in. and must be increased to 12 in. Then we shall have to reconstruct the 8-in. takeoff going through the wall on an angle from the top side of the header, and thats a tough job itself, so you can see what we are up against".

After studying the problem, Mr Cox suggested cutting the 12-in. under-floor line at the indicated point in the trench (Fig. 2) welding a slip-on flange, then putting in a 45-deg ell and continuing as shown. That would require a hanger to carry the weight formerly supported by the base ell. The important thing was that the header didn't need to be changed and that the 12-in. spool connection was not low enough to interfere with headroom.

The plan was accepted by the mill engineer and the job completed in eight instead of 48 hours.

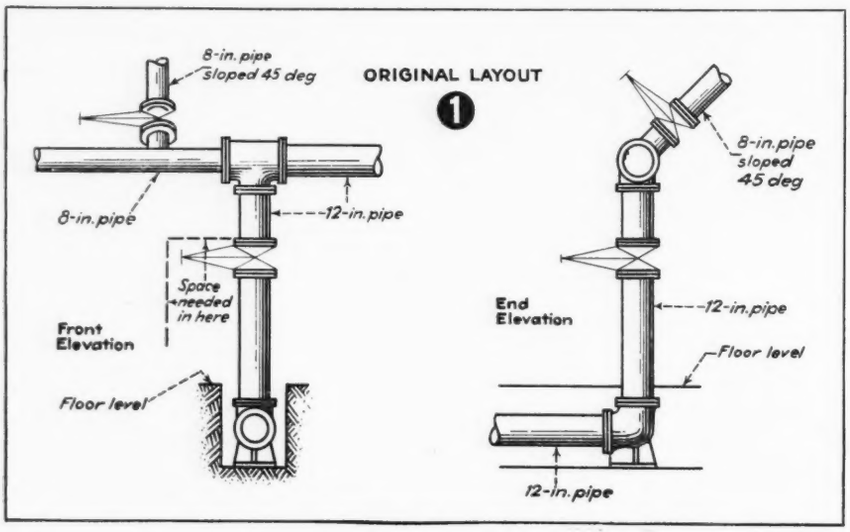


Fig. 1—Front and end elevations of original layout. The riser had to be moved to make room for a new generator. Original plan would have closed mill for two days

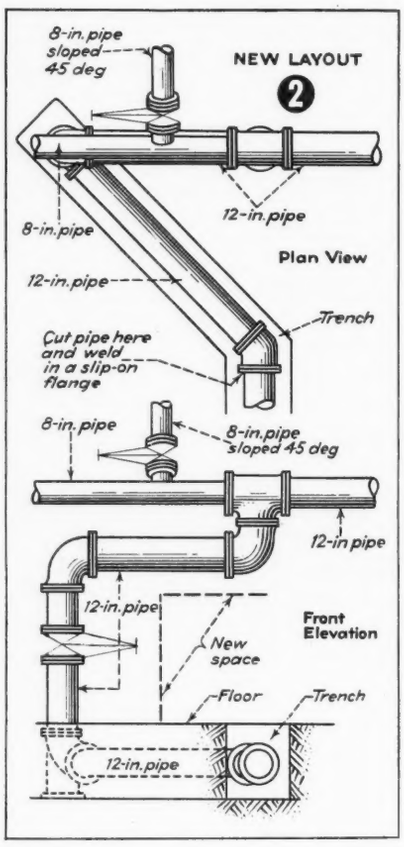


Fig. 2—Alternate plan was adopted and the job completed in eight hours, with no changes in overhead header required

As the war progresses, changeover jobs of this sort will become increasingly difficult. On the one hand the need to expand plants while maintaining production will increase. On the other, manpower shortages will increase while there will be no easing of the strategic piping, valves and fittings situation. Thus a heavy premium will be placed on ingenuity that can make necessary changes quickly with a minimum of labor and of new material.

Rectifier in Field Circuit Improves Motor Control

By L E MILLER
D C Design Engineer, Reliance Electric & Engineering Co

A dry-disk rectifier added to the generator-field circuit makes possible rapid adjustment of variable-voltage-controlled motor; permits retaining potentiometer rheostat

▶ WHEN VARIABLE-VOLTAGE DRIVES are used to obtain large speed changes it may be desirable to control the generator-field current by a potentiometer rheostat, Fig. 1. By this method, the generator-field current can be varied from maximum to zero without using an infinite resistance in the rheostat. In Fig. 1, when the slider is at the extreme right, full voltage impresses on the field windings and maximum current flows. As the slider moves to the left, voltage across the field windings decreases gradually to zero when the slider reaches the extreme left.

Fast Motor Control

Circuits similar to Fig. 1 are satisfactory except in cases where the generator-field current must be changed rapidly to slow down quickly the motor driven by the variable-voltage generator. Under such circumstances the ordinary potentiometer circuit allows the field current to flow for an appreciable time after the slider has been moved to the extreme left position. As the slider moves to the left, the remaining resistance in R_1 and R_2, and resistance of line A forms a discharge path for the field coils, until the discharge path consists only of low-resistance line A.

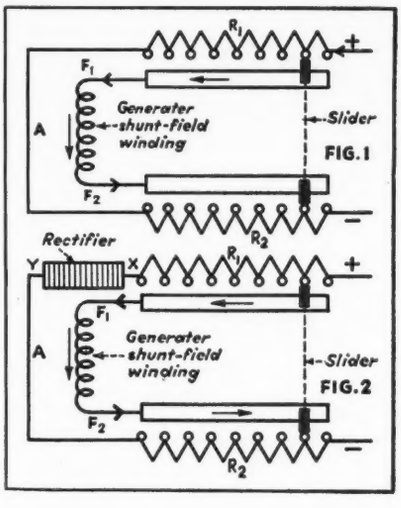


Fig. 1—Potentiometer generator-field rheostat circuits like this are satisfactory except where rapid change in generator field is required. Fig. 2—Dry-disk rectifier in circuit makes it possible to use a potentiometer field rheostat, even where generator-field change must be rapid

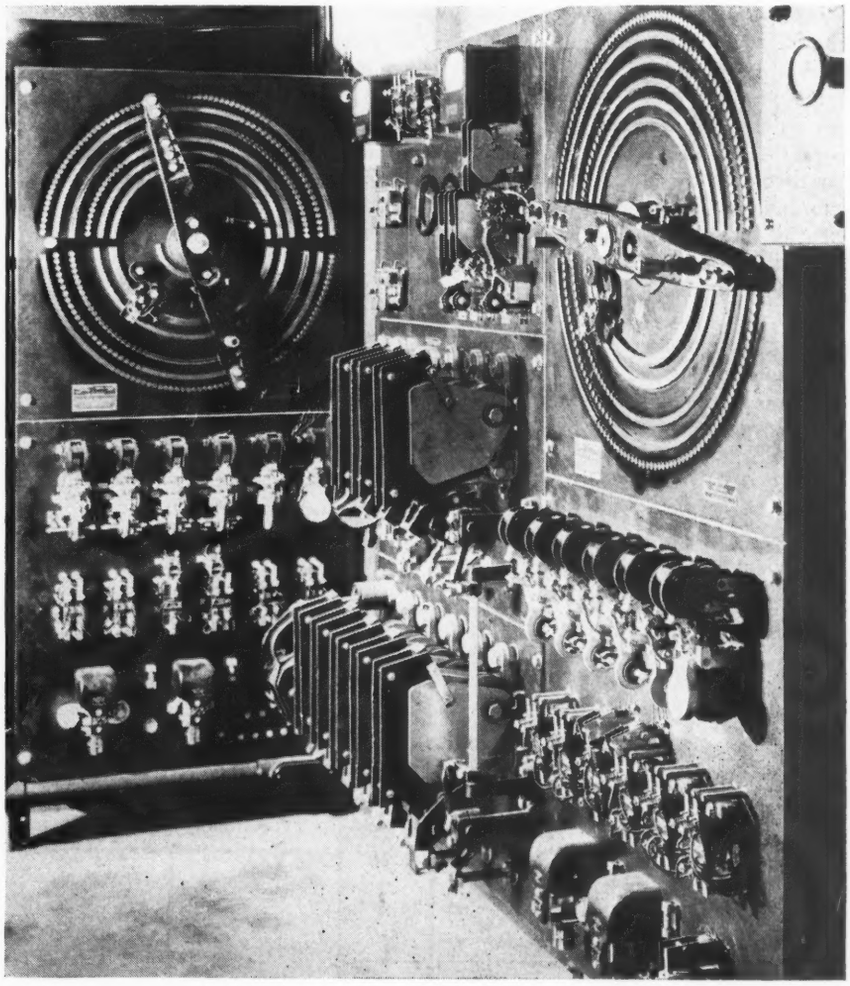


Fig. 3—Business side of potentiometer generator-field rheostats that provide combined voltage and field-current control for variable-voltage drives

At the start, current was flowing into the generator field coils at F_1 and out at F_2. As the slider moves to the left, the self-induced voltage set up in the field coils causes current to continue to flow out at terminal F_2 and in at terminal F_1, even though the external impressed voltage has been reduced to zero. This current exists for a sufficient time to reduce materially the rate of retardation possible with this method.

An interesting problem of this kind was solved by the use of a dry-disk rectifier, XY as in Fig. 2. The rectifier is connected so that current will flow from X to Y, but can not flow from Y to X, thus acting as a check valve, allowing current to flow in one direction only. Under ordinary conditions current flows through line A from top to bottom without interference by the rectifier. When the operator moves the rheostat slider rapidly to the left, discharge current tends to reverse through line A and flow from bottom to top, but is prevented from doing so by the rectifier. With the circuit, Fig. 2, the advantages of a potentiometer rheostat can be retained while at the same time rapidity of field-current change can be as great as with a series-type rheostat.

More Engineers Share Their Power-Pooling Experience

POWER'S September special section reported on several industrial power plants operated in parallel with public-utility systems. Here are the experiences of six more plants

▶ LONG BEFORE government agencies asked utility companies to make a study of the possibilities of interconnection with industrial power plants in their districts, this was being done wherever necessary to meet an emergency or to serve mutual interests better. The extent of this interchange makes it apparent that the utility companies and the owners of industrial power plants need no urging by outside agencies in pooling their resources to meet a possible power shortage. The following experiences are further evidence of this cooperation, in addition to those given in September POWER.

Fig. 1 shows simplified connections for one of the outstanding examples of power pooling. In this industrial power plant two 6250-kva turbine-generators feed into an 11,500-volt bus in the plant, which is tied to an outdoor bus to which a 9000-kva utility line connects. In addition to the two main generators, a 550-volt unit connects to a 550-volt bus in the powerhouse. This bus ties to the indoor 11,500-volt bus through a bank of 11,500/550-volt transformers. From the 11,500-volt bus in the yard, power is taken into substations, to supply plants No. 1 and 2 through 11,500/550-volt transformer banks.

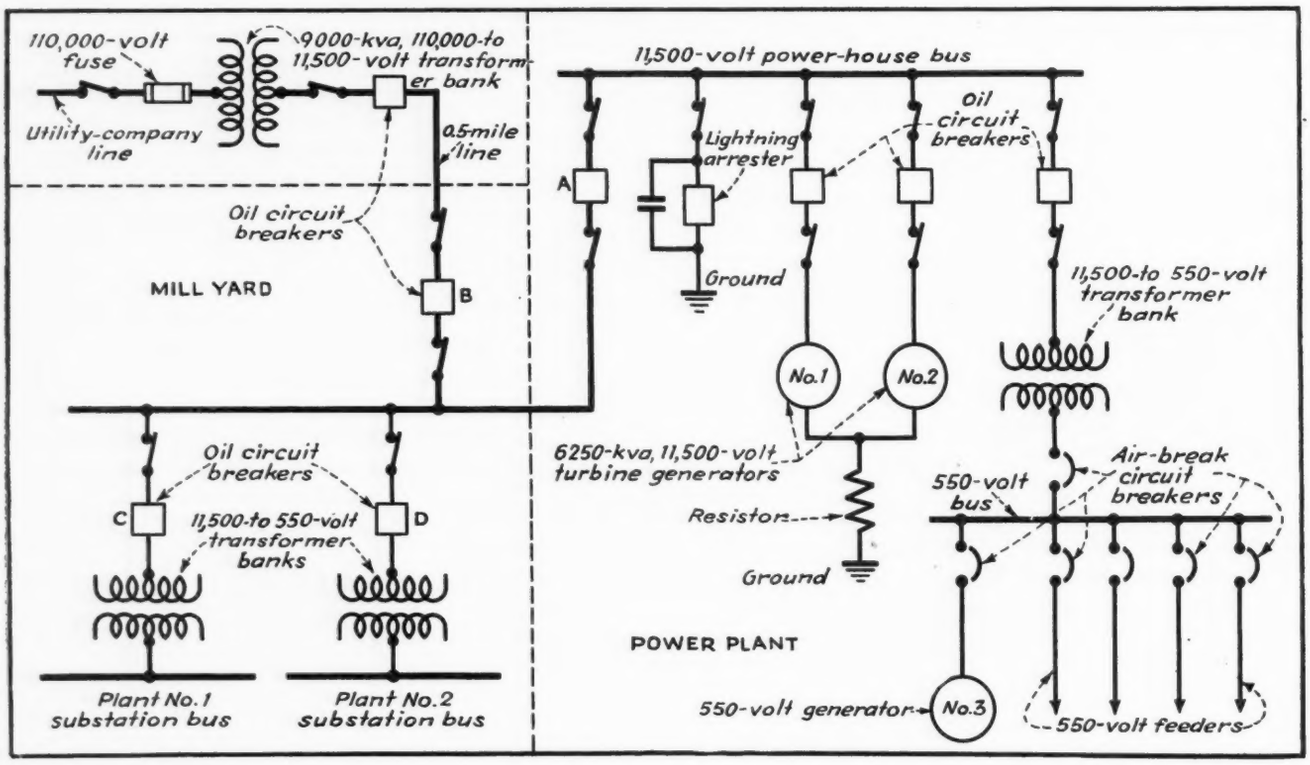
Differential Relays

Differential relays protect the main generators against faults in their windings and the utility transformer bank carries fuse protection on the 110,000-volt side and overcurrent relays on the 11,500-volt side. Power flow between the two systems is controlled manually. Before the tie between the two systems was made, a study of possible short-circuit currents showed that all circuit breakers had ample capacity. The utility transformers are half a mile from the industrial plant.

Of this interconnection the plant engineer of the industrial reports: Our power plant was designed for isolated-plant operation, but two months before completion the local power company approached us. Because of an acute power shortage in the district, we negotiated an agreement for an interconnection between the two systems. We had made no provisions for this in the original design, but decided that a simple and satisfactory connection could be made by installing an additional 250,000-kva outdoor oil switch, *B* on the diagram. Synchronizing and control switches were installed on metalclad switchgear in the powerhouse with overload and low-frequency relays.

Our contract for obtaining all power from the power company did not expire until Oct 15, 1941, but we began on Aug 21 to carry our full load, and supplied the utility system 4000 to 5000 kw continuously until Dec 24 of the same year. Since then we have

Fig. 1—An outstanding example of power pooling—two 6250-kva turbine-generators interconnected with the local utility system



normally supplied power to the utility between 6:00 a.m. and 10:00 p.m., but there have been times when we operated at maximum capacity at the power company's request. During this period we have supplied over 750,000 kwhr in a single week to the power company. This equaled 35% of the power company's total kwhr sales. Since April of this year our load has increased to where we can now supply only 2000 to 3000 kw to the power company, but we feel we are still an important part of the local power pool.

No Operating Troubles

We have had no operating troubles except in two cases. During a failure of the 110,000-volt line all undervoltage devices on our power-plant-auxiliary-motor controls opened, causing a complete plant shutdown. These opened before the overload relays on the tie breaker (*B*) could trip it out. This was temporarily corrected by blocking in the magnetic starters on the motors until maintained-contact pushbutton stations could be obtained and installed in the control circuits.

In another case a breaker 60 miles away from our plant opened in the supply to the 110,000-volt line when there was no fault on the system. The overload thrown on our plant caused breaker *C*, supplying the main mill, to open on overload because of low voltage. The added load on our plant was not sufficient to operate the overload relays on tie switch *B*, as they had been set to permit us to supply up to 8000 kw to the utility when part of our mill was not operating.

We have on order and will install within the next few weeks on breaker *B* a relay that functions on the rate at which frequency of the system decreases, and not on frequency alone. We believe that this relay, which has worked successfully on other connected systems, will clear any trouble that may occur on the system. Should this fail we can install additional current transformers and relays on the 11,500-volt feeder leaving the powerhouse to trip breaker *B* and set these relays to function at a lower current than those on the feeder breaker *A*.

Considering that an interconnection was not planned or requested until a month before our plant was completed, and that the present tie system was installed because of its simplicity, and because the equipment was immediately available, we have had remarkably little trouble. Installation of protection now on order should eliminate difficulties from trouble outside our own system.

The engineer of another plant writes:

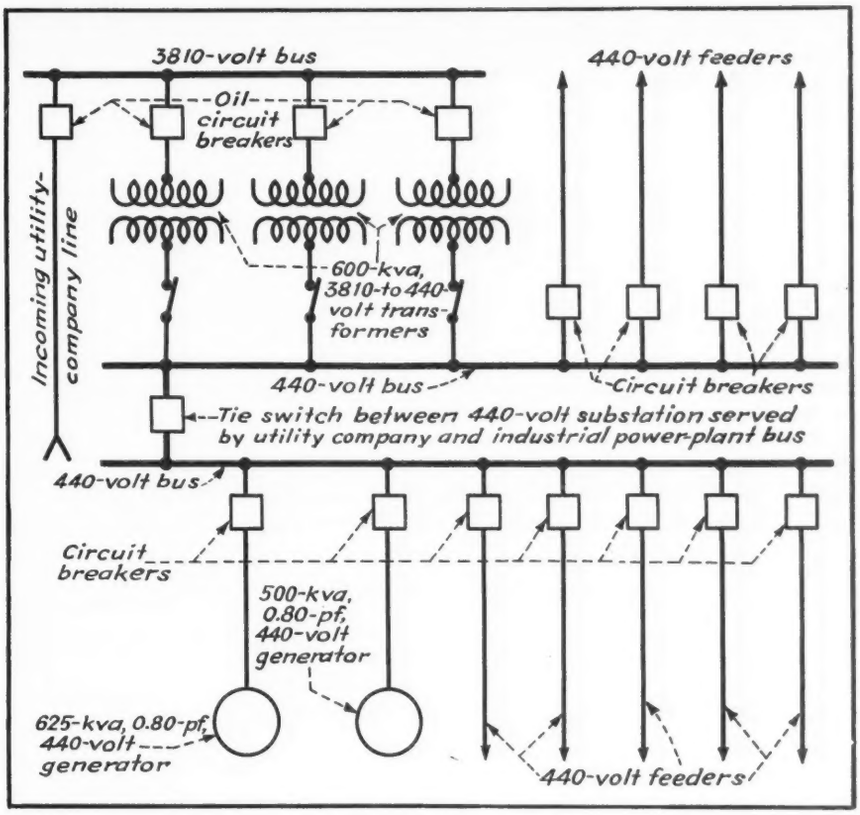


Fig. 2—Plant operation in parallel with utility power supply improves efficiency

About seven years ago we built a new malt house and made it independent of the rest of the plant. We installed a boiler to supply heating and process steam and built a substation to take power from the local utility company. Two years later we added a new barley storage and cleaning house and supplied power to it from the malt-house substation. This did not prove to be as satisfactory as we might have wished.

First, it left the utility power supply separated from our generating station in the older part of the plant. If an outage occurred on the utility line we could not supply power to the malt and barley houses from our generating station. Our plant was not large enough to carry the maximum load, but it could keep the more important elements of the processes in service.

During the building-heating season low-pressure-steam requirements for heating and process exceeded that from engines when operating under full load. In the older part of the plant there was not sufficient load to make maximum use of the engines and we were losing the opportunity to generate a lot of power that we were buying from the utility at about three times the cost at which we could generate it.

To correct this condition we installed a new boiler in our power plant to provide ample steam to operate the 500- and 625-kva engine-driven generators under full load. The engines had sufficient capacity to drive the generators at their full kva rating and unity power factor. To take full advantage of this we improved our load power factor to nearly unity. We installed a circuit breaker and tie between the substation and power-plant 440-volt buses and made provisions for synchronizing our plant with the utility system. Before connecting the two systems together we made a study of our circuit-breaker capacity and the possible short-circuit currents that we could get when operating in parallel with the utility. Some of the older breakers were found to have insufficient capacity for the new condition; these were replaced by larger ones.

On the utility line the circuit breaker is equipped with reverse-power relays. These relays are set to trip the breaker on a reverse-power flow of 50 kw or more into the utility line from our plant. The transformer circuit breakers are also equipped with reverse-power relays set to trip the circuit breakers at 200-kw reverse-power flow.

Now we operate our plant to generate all the power we can up to the limit of exhaust steam that can be used in heating and process systems. Excess of power above this is purchased. During a large part of the heating season we can operate with the engines practically fully loaded at

1100 kw whenever demand requires.

Operating in parallel with the utility has been highly satisfactory. We have been able to reduce our power costs and at the same time increase the reliability of our power service. We operate 24 hr per day, 365 days a year, and in two years there have been only two half-hour periods when we have not been tied in with the utility. These outages were caused by severe storms. Control of power flow between the two systems and of the voltage of our plant is done manually. We have never been called upon to supply power to the utility system, but we could do so, particularly during off-peak periods.

University Interconnects

How a large city handled a power shortage by tying in with isolated power plants is related by the electrical engineer of the city's power and water board. When a shortage developed, the city's power and water board was requested by telephone to connect to its system all practical sources of electric power. The university had excess power from its plant and offered to make this available. On July 26 the job of making the interconnection was turned over to the engineering departments of the two interested parties and in three days power started to flow into the local system.

The university had two 500-kw steam-turbine generators, adequate boiler capacity, and a switchboard with a spare panel but without instruments or oil circuit breaker. The university supplied an oil circuit breaker from long-time storage, which was reconditioned for service. Necessary switchboard instruments were provided by the power board; which also built a 2300-volt 3-phase 1100-ft line, a 1000-kva 2300/13,200-volt wood-pole substation and strung 220 ft of 13,200-volt line from the substation to an existing 13,200-volt radial feeder. This permitted a partial use of the available generating capacity. A week later installation of synchronizing equipment and additional relays were completed and the two systems paralleled. Power transformers and switchboard instruments used were 23 years or more old.

From June 29 to Dec 25, 1941, the university power plant supplied 1,352,000 kwhr to the local utility system, during which time the average hourly demand varied from 75 to 655 kw. For five weeks this year the university plant supplied power to the utility and is now available as standby capacity.

A woolen mill with one 500-kw steam-turbine generator and adequate boiler capacity also entered this city pool. Existing generator switching and instrument panels were used for both mill and power-board operations so that only a breaker was necessary to make the connection into the power system. For this connection the power board used a 1100-amp modified network protector with synchronizing equipment, constructed a double 220-volt 3-phase line 150 ft to a 500-kva 220/13,200-volt step-up substation, and 120 ft of 3-phase line to an existing 13,200-volt feeder. The automatic reclosing equipment at the substation end of this feeder was changed slightly to permit successful parallel operation with the generator. The network protector was a spare unit for an underground grid system and the protective-relaying equipment had to be changed for generator use.

Power from this plant was available only when the mill was shut down, from 10 p.m. to 6 a.m. four days each week, and from 10 p.m. Friday until 6 a.m. Monday. Operating that way from July 20, 1941 to Jan. 8, 1942, the mill plant supplied 1,062,000 kwhr to the utility. During this period loads up to 560 kw were supplied by the mill plant.

For five weeks during the middle of this year this plant again supplied power to the local utility. This connection is also available as a standby between the mill and local utility.

Woodworking Mill

The power-generating facilities of a woodworking mill were also connected to the power-board's system. This plant operated one shift for 5½ days. It had a 500-kw non-condensing steam-turbine generator supplied by a boiler fired with shavings and sawdust. Connections were made to the power-board's lines as in the two previous cases. Most of the power generated was produced when firing waste fuel. An attempt to use coal was not successful because the boiler furnace was not suitable. However, in six months' operation this plant supplied 169,000 kwhr of badly needed power to the utility system and carried up to 300 kw.

In another woodworking mill part of the load was supplied by a 500-kw generator and part from the lines of the power board. This plant also worked one shift, 5½ days per week, and the boiler was fired with sawdust and shavings. The sub-station of the power board had sufficient capacity to handle the generator output so that it was only necessary to install a set of 440-volt disconnect switches and synchronizing and metering equipment. In 5½ months this plant supplied 268,000 kwhr to the local utility system and handled loads up to 250 kw in spite of boiler operation being limited by waste-fuel firing.

These four plants, though comparatively small and forced to take care of their own normal loads, were able to supply, during about six months, nearly 3,000,000 kwhr of badly needed power to the local utility and met demands up to 1765 kw. These examples show clearly the help that even a few small plants can offer in a power pool.

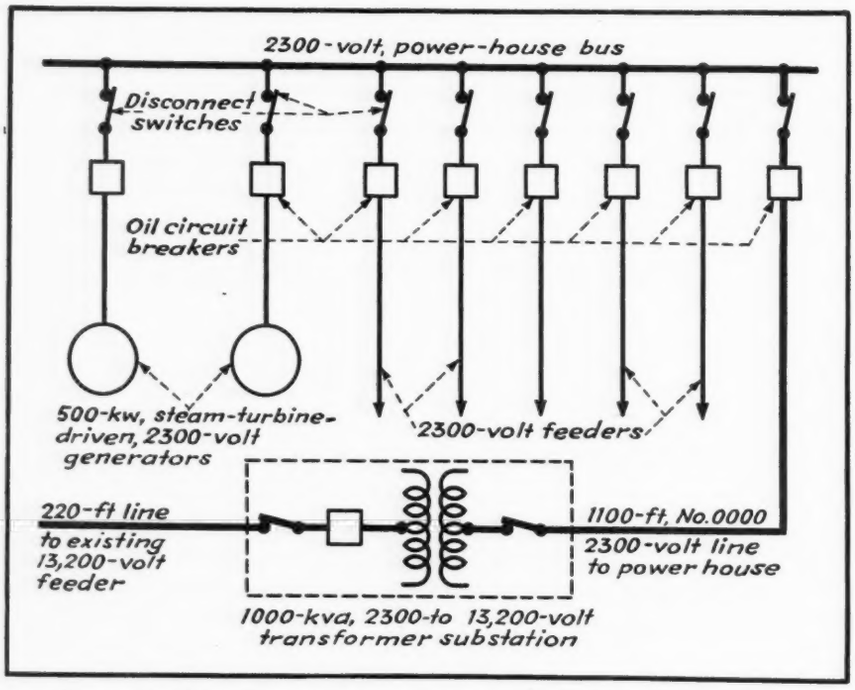

2300-volt, power-house bus
Disconnect switches
Oil circuit breakers
500-kw, steam-turbine-driven, 2300-volt generators
2300-volt feeders
220-ft line to existing 13,200-volt feeder
1100-ft, No.0000 2300-volt line to power house
1000-kva, 2300-to 13,200-volt transformer substation

Fig. 3—To help out in an emergency, this industrial plant interconnected with the local utility system in three days after getting the go-ahead order

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS • MAINTENANCE HINTS • QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

From Stationary Steam to Marine Engineer

One of the best ways to find out if a landlubber would make a good marine engineer, says General Electric's Frank V Smith, is to rub a little salt behind his ears and see if he can hold his meals. The sea broadens experience, teaches self reliance and decision

ONE OF THE MAIN differences between a stationary engineer and a marine engineer is that one has sea legs and the other hasn't. Both are trained to look on a piece of machinery from an operator's viewpoint and as something to keep in running order. Except for this slight similarity in attitudes, comparisons end. The marine engineer walks with a swagger and sleeps in a bunk, whereas the stationary engineer is a landlubber who walks with assurance that the earth isn't going to jump up and hit him every other step.

Except for fuel and food, a ship is self sustaining once it leaves the dock. It makes fresh water out of salt water, and its cruising radius depends upon its bunker and food-storage capacity. In early sailing-ship days, when sailors lived on hard tack and salt horse, ships made some mighty long voyages. Mechanical drives altered this picture and sailing time between ports is now apt to be quite short.

Ships Make Power Too

Ships contain the power-generating as well as the power-using apparatus and there is nothing on shore quite like a propulsion plant. Auxiliaries aboard a ship comprise those which keep the main power plant running, such as circulating, condensate, and feed pumps, those which steer the ship and aid in mooring it in port, cargo-handling equipment, drainage and ballast systems, lighting plants, and last but not least the galley equipment (with its personnel) which either keeps the crew happy or morose, depending upon the quality of the product turned out.

Frank V Smith, engineer, teacher, author and philosopher, believes that knowledge "taken in through the fingers" helps anchor the old principle of "tell 'em why". Did a trick with the U. S. Navy in World War I as officer on a repair vessel. Jobless by Armistice, he took over a Navy repair yard, then came with GE to train officer personnel for the U.S. Shipping Board. He's had a part in developing better power engineering for ships ever since. Now he is special assignment engineer and troubleshooter for the Federal and Marine Department of General Electric

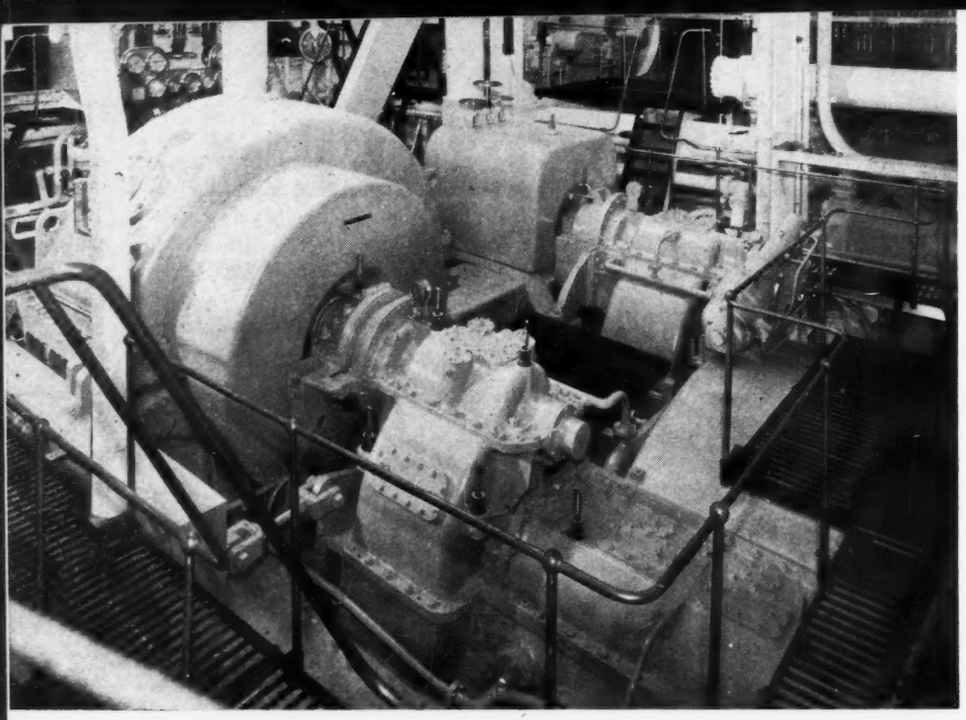
Stationary engineers on land are generally specialists in one end of the game or the other; that is, the power-generating, or power-using, but not both. There being so many applications on shore, ranging from rolling mills, sugar refineries and manufacturing plants on the one hand, to ice-cream plants, bottling works and apartment heating plants on the other, no hard and fast rule or generalization can be made in regard to the IQ of the stationary engineer. The best way to find out if a landlubber would make a good marine engineer is to rub a little salt behind his ears and try him out. One or two trips are generally sufficient to tell if he is going to be able to hold his meals or not.

If you want to be useful, and at the same time see the world and absorb a little of the romance that comes with having a girl in every port, take a birds-eye view with me of a modern ship's fire and engine rooms.

Brains Over Brawn

As for the fire room, the day when a hard-boiled chief chased a shanghaied crew around with a slash bar to make them work is over. Shoveling coal in sea-going ships is a lost art, and our marine designers have done everything but put swivel chairs in the fire room. If some of the old timers could wake up they would say that the fire room had really gone high hat.

Shifting from coal to oil on ships did away with the strong-backed weak-minded "black gang," but it also brought with it another quota of problems. The first of these was how hot to heat fuel oil for good atomization; before this was understood globs of oil were thrown into the furnace, tubes



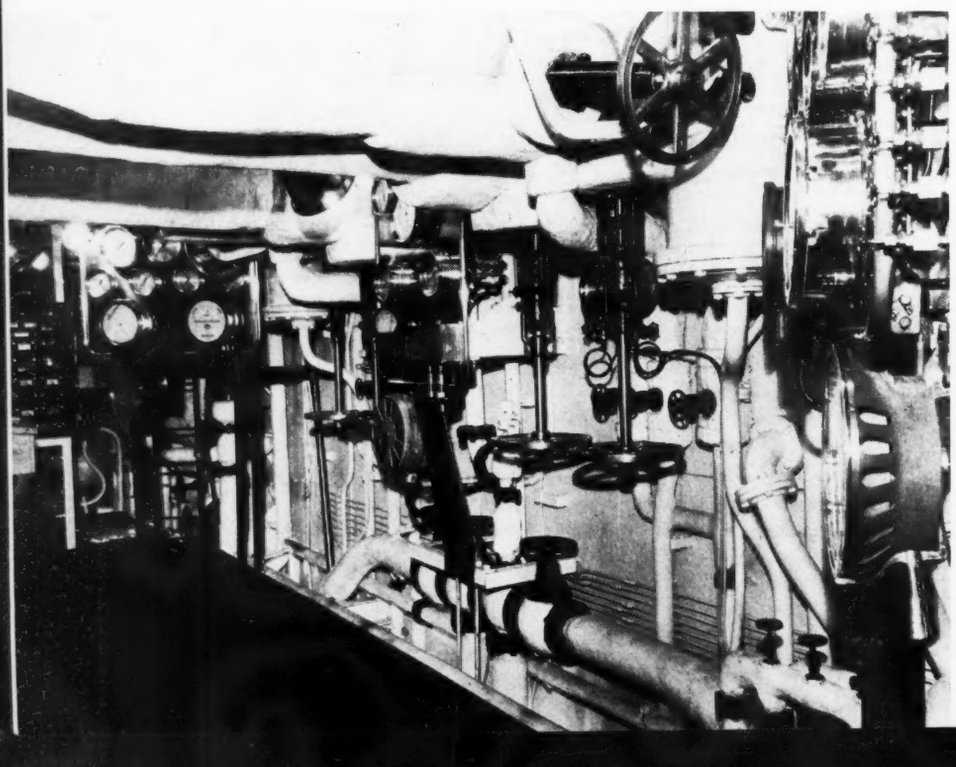
The engine room is unlike anything ashore because the main power-generating unit is attached to the propeller all in one lump. Here a cross-compound, double-speed-reduction turbine-gear set delivers 8000 hp to the single shaft

sooted, and smoke billowed from the funnels most of the time. The second problem was to find out how much air to admit to the furnaces; if too little air was admitted part of the oil burned to carbon monoxide instead of carbon dioxide with a resulting heat loss of about 14,000 Btu per lb of oil; if too much air was admitted the combustion-chamber temperature dropped and the stack temperature rose, with a real efficiency loss.

During the transition period, hand control of air regulation, burner oil pressures, and the setting of oil-heater temperatures was left entirely in the hands of the crew, with about as many different results as there were ships. Automatic combustion control came as an answer to a necessity and to overcome the haphazard judgments of run-of-mine engineers. Preheated air to the furnaces, correct atomization, and closely regulated air supply have tended to put marine boiler plants in the forefront of modern developments.

Fire-room auxiliaries consist of fuel-oil pumps, fuel-oil heaters, and either induced- or forced-draft blowers. The fire room is a cooler place than the engine room, and with polished floor plates has become one of the show places on a modern ship. Experience in the fire room on a ship is an educational opportunity, and a young man who has mastered the mechanical details of the boilers under his care, the theory of combustion, and the operation of the co-related auxiliaries, will be worth his weight in gold in any boiler plant ashore when this war is over.

The day when a hard-boiled chief chased a shanghaied crew around with a slash bar to make them work is over. This main control station includes maneuvering valves, gage boards, telegraphs, everything but a swivel chair



The engine room on a ship is unlike anything on shore because the main power-generating unit is attached to the driven unit (the propeller) all in one lump. Turbines operate at high speed, and propellers at slow speed, which makes it necessary to provide some form of speed reduction. Two forms are used on ships (1) reduction gears, and (2) electric drive.

Ship Fractions

Starting from the characteristics of the driven apparatus—the propeller—the control functions become quite clear. The speed of a ship varies almost directly with the propeller speed, the torque as the square of the propeller speed, and the horsepower as the cube of the propeller speed. Putting this into real figures means that at half speed, the propeller torque is one-fourth of full-load torque and the horsepower only one-eighth. These ratios stand good for one condition—clean hull, no wind or seas, same displacement, and same depth of water. No such navigator's paradise exists in practice. Ships are heavily laden, lightly laden, or anything in between; hulls are clean or covered with barnacles; there are seas and wind, favorable or unfavorable; and water may be shallow or deep.

In laying out a ship's itinerary, various legs of the voyage are made at different speeds so as not to arrive in ports at midnight. From an engineer's point of view he must be able to set and hold the speed of the propeller under varying load conditions, manipulate the hand valves to secure the best economy under various loads and speeds, stop and start without hesitation during maneuvering, or in other words have a full knowledge of the operation of the apparatus under his care. Instruction books are issued by the various manufacturers of propelling equipment, and these should be understood from cover to cover by the seasoned chief engineer and his aspiring understudies —the first, second and third assistants.

Modern turbines are a work of art and designed to produce a high over-all economy. Steam is bled from various stages for feed-heating purposes, so that the maximum quantity of steam operates on the regenerative cycle and the minimum amount of latent heat is pumped overboard in the condenser circulating water. It is fine operating experience

to handle a modern turbine plant aboard a ship, as all the doo-dads are there for economy the same as on shore.

The condenser plants aboard ship have one advantage over shore plants, and that is there is always plenty of circulating water available. As the condensers are below water level, the only power required for pumping is that required to overcome friction in the intake and discharge pipes and condenser tubes. Two- and 3-stage air ejectors are installed, drips returned to the condenser hotwell for deaeration, and the feed system operated on the closed, air-free principle. Feed-pump boosters may or may not be installed between the condensate pump and feed pumps, and the placing of the feed pump ahead, behind, or between the feed heaters differs on various installations. These are the things that the seasoned engineer looks into when he takes over a new plant—the location of the apparatus, and how it fits into the cycle.

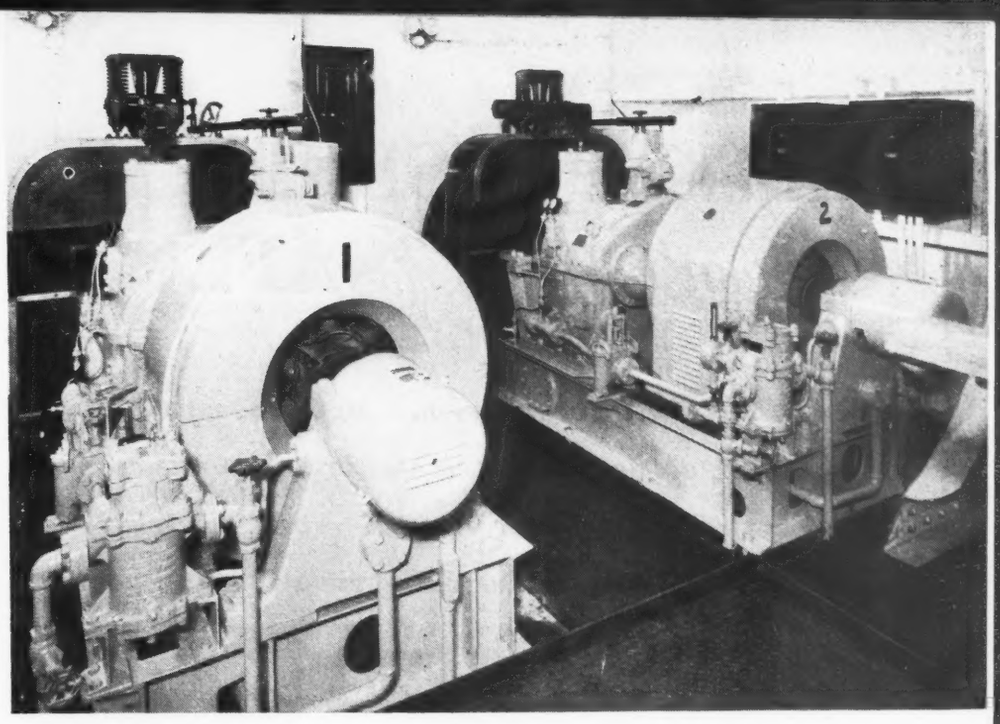
All water used for makeup feed on a modern ship is either made or reconditioned in the ship's own evaporator plant, and chance is not taken on raw water purchased ashore. Modern high-pressure boilers require pure air-free feedwater, and one will find marine engineers equally as fussy as stationary engineers in this respect.

Whole Contraption Moves

Viewing a ship as a floating hotel, power plant and storage warehouse, and considering that the whole contraption moves from arctic to tropical climates, one can visualize what a versatile thing it must be. A few of the things that come to mind are cold-storage plants, fire systems, fresh-water and sanitary systems, hot and cold water piped to the officers' staterooms and crews' quarters, drainage and ballast systems, lighting, telephone, and ventilating systems, air compressors, and machine shops, all of which are below deck.

The above-deck equipment consists of cargo winches for loading and unloading the ship, capstans, anchor windlass, boat winches, searchlights, steering gear, and the navigation equipment.

To supply power for all of the miscellaneous applications aboard ship other than propulsion requires an auxiliary generating plant of considerable size and importance. As a general rule turbine-driven generators are supplied, with diesel-engine-driven generators as a standby. The turbine sets are supplied with their own condensers; power is distributed to various parts of the ship over trunk lines and then to the individual services from distribution panels. The ship's electrical force takes care of the auxiliary generating plant and distribution systems, and also looks into the trouble when someone in the engineering force pushes a "start" button, and nothing happens.

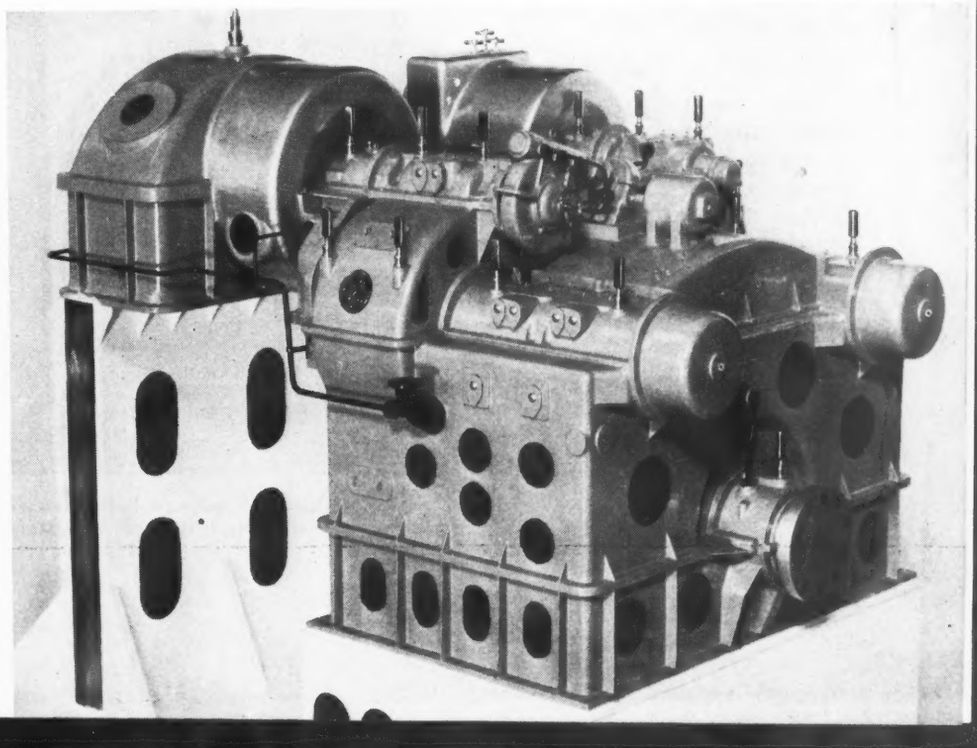


A ship is a floating hotel, power plant and storage warehouse. These 200-kw 240-v 3-phase geared-turbine auxiliary units move with the whole contraption from "the halls of Montezuma to the shores of Tripoli" to carry munitions of war

Sitting on the sidelines, and taking a psychological squint at marine engineering, then at stationary engineering, and evaluating what characteristics pop out in a man after having one or the other as a background for a few years, it seems that marine engineering puts the responsibility directly on the man and develops a self reliance that one can get in no other way. If telephones, service stations, and manufacturers' agents were handy to the seafaring man, no doubt he would learn to shift the responsibility a little also. But this easy solution isn't available to him 3000 miles out at sea.

The sea gives one a broad experience, teaches self reliance and decision, broadens one practically by letting him rub elbows with peoples of all climes, and last but not least, puts a little glamour and romance into his vest pocket that he can draw on in his old age. Nothing like having lived a full life. The opportunity for young blood and old salts was never greater than in the present emergency need for seafaring men.

Modern marine turbines are a work of art, bleed steam from several stages for high economy and have all the doo-dads of best shore machines. This model illustrates the arrangement of double-reduction gears for single-shaft propulsion



'LOW-PRESSURE' *Doesn't Mean* 'SAFE'

When low-pressure boilers are involved, many owners and operators forget that careful installation and operation are needed for safety. A F Norcross, supervising engineer, Douglas L Elliman & Co, gives practical pointers

IF HEATING REPRESENTS the only steam load in a building, it is common practice to install low-pressure boilers, that is, steam boilers for internal pressures of 15 psi or less and water boilers for 30 psi or less. Too many engineers and building owners assume that such equipment is safe "by nature", in other words, because it operates at low pressures.

Insurance-company records show this to be a dangerous fallacy; operation of low-pressure boilers has produced or contributed to casualties of the following types: (1) scalding by steam or hot water, (2) burns caused by backfires, (3) personal injury and property damage resulting from boiler explosions, and (4) carbon-monoxide poisoning. Many boiler accidents occur during the coldest weather, causing maximum inconvenience to building tenants and thus maximum trouble for owners and operators.

This article reviews the manufacture, installation and operation of low-pressure boilers, showing that the "assumed" safety can be turned into real safety by attention to the rules which experience lays down.

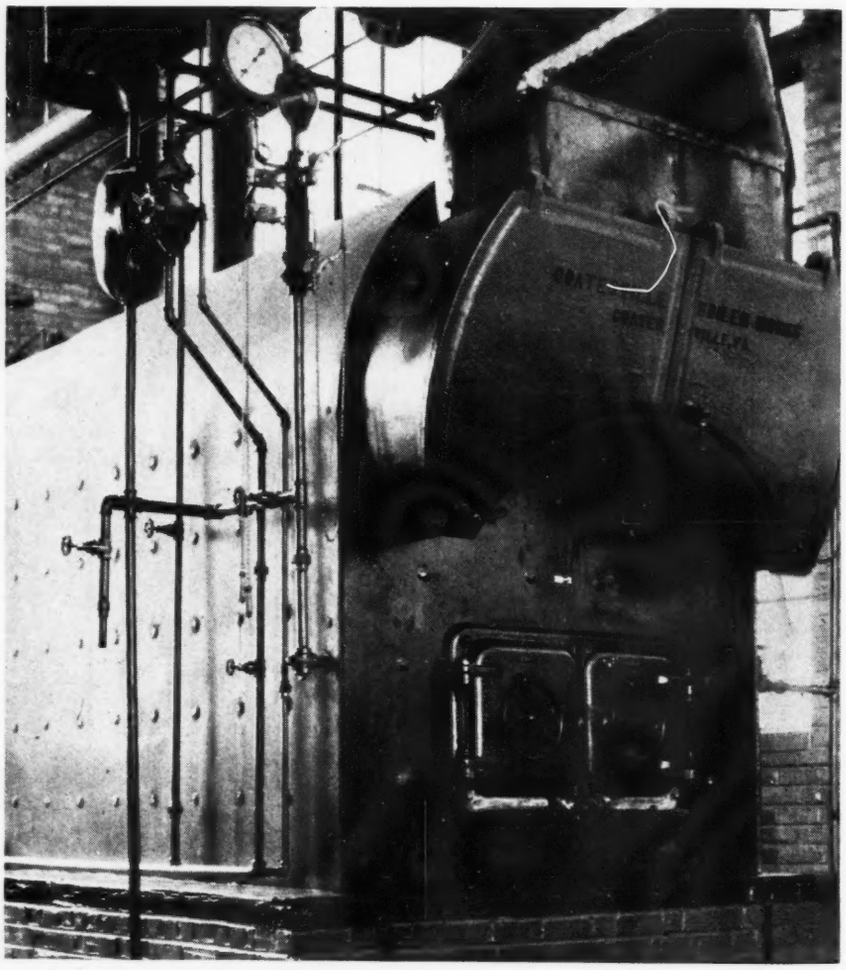
Unsafe Conditions

Unsafe conditions in early boilers often resulted from faults in materials or methods of manufacture. In old steel boilers unsafe conditions included flaws in the metal, imperfect riveting, imperfect staybolting, lack of sufficient staybolts, and metallic fatigue caused by expansion and contraction strains. Old cast-iron boilers sometimes showed these conditions: sand and blow holes, cold-shot metal, unequal thickness of wall sections caused by shifting of cores during casting, core rods and sand left in castings, crystallization of iron, strains caused by sluggish circulation of boiler water or by mud or scale accumulations at low points, strains caused by improper assembly, and lack of uniformity in machining and tapping pipe and nipple openings.

Research and improved manufacturing methods have brought about an improvement in designs to give free circulation of boiler water with maximum absorption of heat from fire and gas surfaces, adaptability to use of coal, oil, or gas, accessibility for cleaning surfaces, and uniformity of material and workmanship quality.

Use of electric welding, X-ray examination, jigs and fixtures for improved machining, chaplets to hold cores in place, and many other innovations, enable today's manufacturers of low-pressure boilers to turn out an improved product. With final inspection and testing in the hands of experts, the modern low-pressure boiler is safe for operation in the service for which it was designed, provided that proper methods of installation and operation are employed.

Improper installation of a boiler can nullify all the safety features built into the unit and turn the equipment into a hazard. The first step, after determination of the size and type of boiler required, is to consider location. The unit should be as near the stack as possible and at an elevation that will provide a proper differential between the boiler water line and the lowest drip points of heating mains and risers. Easy access for proper cleaning



The modern low-pressure boiler is safe for operation in service for which it was designed, if proper methods of installation and operation are employed

of heating surfaces and for repairs is particularly important. Return-tubular boilers have been installed so that tube replacement was impossible; access to clean-out doors, handholes, or return lines is extremely difficult on some boilers installed in pits.

Make sure the foundation of the boiler setting is of ample area and proper construction to withstand settling. Bear in mind that the boiler connects to the heating system by rigid piping and any excessive strain, such as might be caused by settling, may break a fitting or cause a crack in the boiler itself. The sudden release of pressure resulting from such a failure of an operating boiler will liberate energy with explosive violence.

For the same reason, proceed with extreme care in assembling cast-iron sectional boilers. Be sure that the installing contractor follows the detailed instructions issued by the boiler manufacturer. Many a new sectional boiler has cracked a section when put into operation because the tie rods were not slacked off after assembly or because other similar detailed instructions were not followed. In other cases, the sections have not been drawn together sufficiently during installation, the mechanic depending on the cement between joints to seal the gas travel.

Insure Air Supply

Many a boiler is installed and inclosed in a boiler room without consideration being given to the question of the air supply necessary to support combustion. Burning one lb of fuel oil requires 200 cu ft of air and about 225-250 cu ft is required for one lb of coal. Carbon, which is the principal constituent of coal or oil, will burn to carbon monoxide if the oxygen supply is restricted. This means, at best, incomplete combustion and, at worst, danger of carbon-monoxide poisoning.

Give attention also to the chimney and breechings; these should be of ample size and should be mechanically tight at all joints to reduce infiltration. Provide proper clean-out doors so that chimney and breechings may be kept free from soot accumulations. The top of the stack should extend above adjacent structures or the entire stack should be remotely located, to minimize backdraft by reflected air pressure. Lack of attention to these provisions has resulted in many fatalities; sudden backdrafts often cause burns.

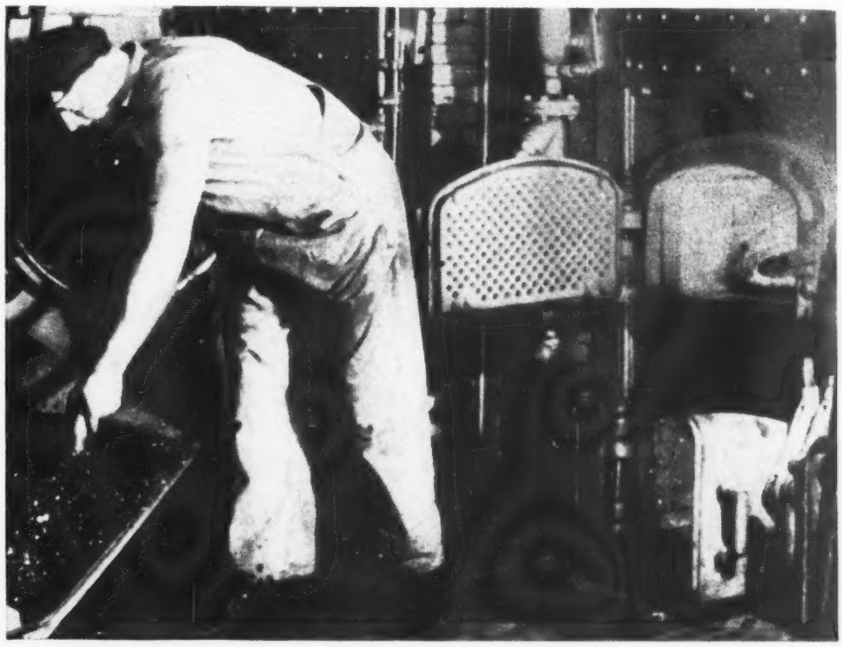
Insufficient draft, or insufficient air supply, resulting in formation of carbon-monoxide, has caused fatalities where there have been defects in breachings or uncemented joints in sectional boilers. These defects allowed carbon-monoxide to escape into the building instead of being exhausted up the chimney.

Steam, water and return-line piping requires its share of careful attention. Control valves on steam mains, water return, and blowoff lines should be in accessible locations. Never install globe valves on blowdown lines; use plug-cocks, gate valves or other full-opening shutoff valves for this severe service. Blowoff or drain outlets of insufficient size form a design defect still found in many cases. Properly designed drain openings are often insufficiently equipped by the installing contractor. It is recommended that full-size drain valves be used on all drain openings.

Avoid low points in the steam connection to the top of a water column; a water pocket will create a false water level in the glass, which may lead to serious trouble. Never install piping in such a way that it will interfere with opening of clean-out doors or access to handholes or manholes. Within the past year, I have run across two cases where clean-out doors could not be opened until obstructing lines were relocated.

Check valves in heating return lines should be installed at the lowest level of the return connection to the boiler. It is surprising how many times a check valve in the main return line is found at an elevation above the water line in the boiler, thus failing to obtain the benefit of the static head necessary to lift the check and allow flow of return water. Installation of return piping in a manner known as the Hartford Loop eliminates need for check valves and will assure maintenance of an even water level in the boiler.

Assuming that a low-pressure-boiler installation has been completed in such a manner as to be inherently safe, there is yet much that can happen in the field of operation that may nullify all of the safety precautions taken by the manufacturer and installer. The human factors of ignorance, carelessness and neglect contribute in some manner to practically all boiler plant accidents.



Unless the boiler-room operator is thoroughly familiar with good operating practice and realizes its importance, safe functioning of the plant is endangered

Undermanned boiler rooms invite trouble. In all too many cases, the boiler attendant is expected to perform so many duties that careful attention to the details that enter into safe operation of the boilers is impossible. Efforts to save money by hiring unskilled firemen or boiler attendants represent false economy. These men are basically responsible for equipment and property of value and should be sufficiently trained to safeguard that investment and prevent accidents endangering life.

Much published information is available regarding safe operation of boilers, fuel-burning equipment, controls, safety devices and other related accessories. However, unless the boiler-room operator is thoroughly familiar with these rules and realizes the importance of following them, the safe and continuous functioning of the boiler plant is endangered.

PRACTICAL AIDS TO OPERATION

Steam Heat Prevents Valve Freezing

IN PLANTS WHERE PROCESSES frequently form icy particles in control valves at the point of pressure control, the valve body is usually steam heated. An efficient sleeve or hood can be made for the valve by using light sheet metal, tailored for the individual instrument. In one application, shown at *A* in the photo, the cover is made in two sections, each having a stiffening rim at the point of contact for connection with small machine bolts. The top section is placed over the valve yoke and is a more or less permanent installation; the lower half is removable at will. Steam flows through a ¼-in. line to the top of the casing and condensate is drained away through a small line attached to the lower half. A control valve above the top section of the casing is used to govern the quantity of steam necessary to prevent freezing.

Santa Monica, Calif.

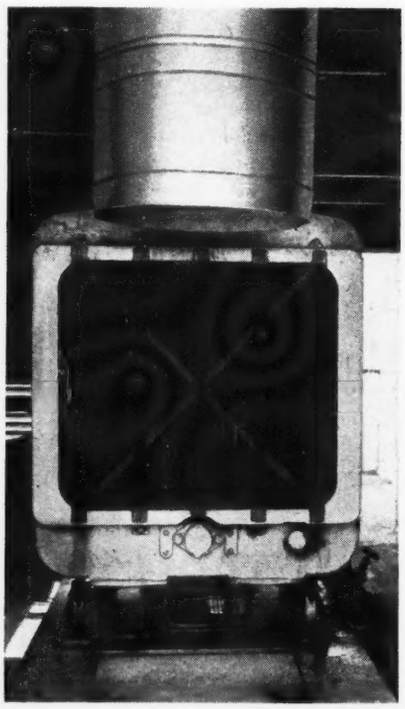
JOHN C ALBRIGHT

Location of Pump-Discharge Check Valve

IF A CHECK VALVE is required in a pump-discharge line to prevent the flow from reversing after the pump has stopped, a gate or globe valve may also be necessary. When pump repairs are being made it is not advisable to rely on a check valve to hold the fluid in the discharge system. As a general rule a check valve is not bubble-tight. Leakage, of no consequence as far as operation is concerned, may prove troublesome when replacements are made. The question then arises, should the check valve be located ahead of or behind the shutoff valve?

Check valves may be called upon to function frequently and may need occasional regrinding and renewing of parts. This can be done only if backflow can be shut off. For this reason the check valve should be placed between the shutoff valve and the pump. Both valves should be located as close to the pump as convenient operation will permit, to prevent trapping large volumes of air in the discharge line when the pump is shut down. This will be forced out through the check valve and up the discharge pipe when the pump is started. A large air bubble in the discharge line may cause objectionable disturbances when it comes out in the receiving tank.

New York, N. Y. ARTHUR H KORN



Roof Ventilator Serves Dual Purpose

ADEQUATE SUPPLY OF COLD AIR for the radiator of gasoline-engine-driven generating unit, without formation of drafts or cold spots within the station building, was assured by leading a large duct from one of the roof ventilators down to just above and in front of the top of the radiator grill, as in the photo.

During cold weather, when wall openings must be closed, suction of the radiator fan draws air down through the duct and thence through the radiator. Hot air is then carried from the

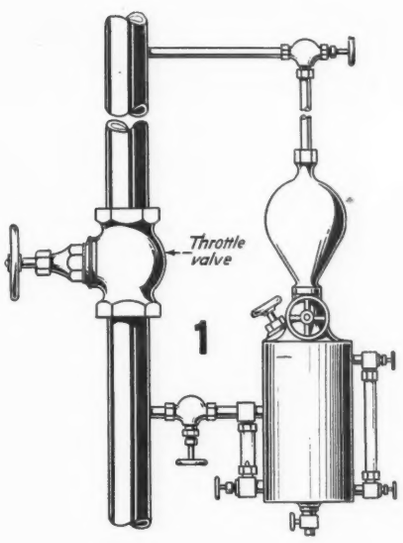
building and air circulation maintained through the other ventilator, located beyond the engine.

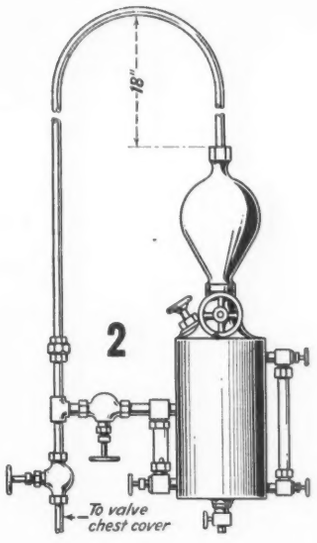
When this system of cooling is used, it is necessary to use a fixed type of ventilator head, or to arrange for manual facing of the inlet above the roof. If this is not done, suction into the ventilator is apt to cause the revolving head to swing into the wind instead of away from it. This may draw water into the building during rain storms.

Houston, Texas CHARLES C LYNDE

Reinstallation Improves Lubricator Operation

ON THE STEAM END of one of our reciprocating pumps the hydrostatic lubricator did not operate satisfactorily. The rate of oil feed was erratic no matter how the lubricator was adjusted. After trying several times to correct the trouble without success we decided that the fact that the lubricator was connected into the steam line above and below the throttle valve, Fig. 1, might have something to do with the bad performance. I therefore connected it into the top of the valve-chest cover, Fig. 2.



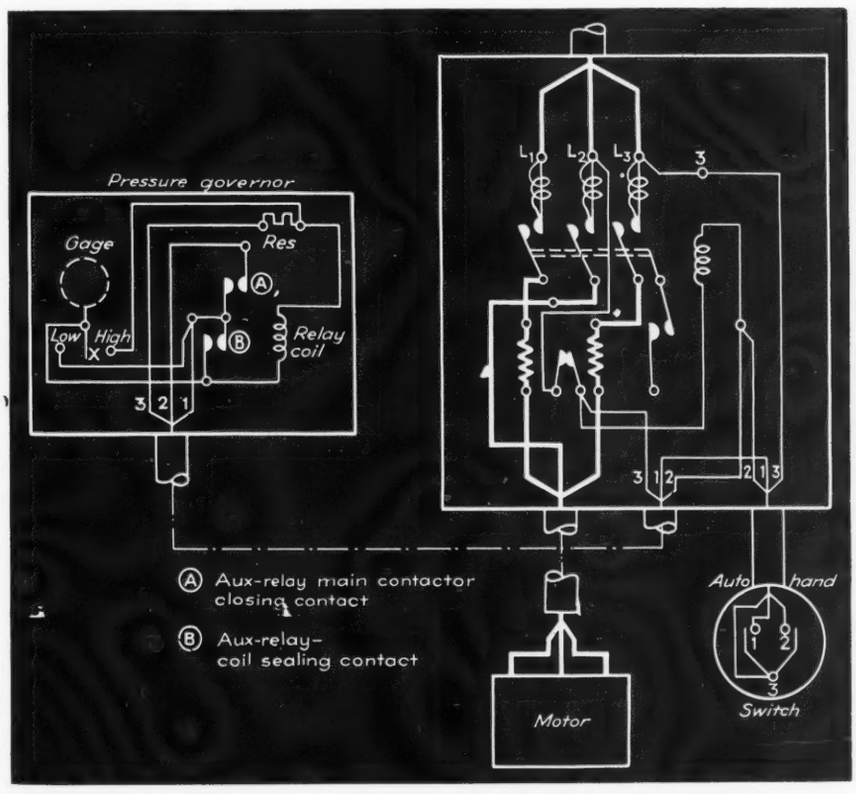


This was done easily by removing a ½-in. plug from the center of the cover, into which I screwed a ½-in. pipe nipple to support the lubricator. Then, after piping up the lubricator with ¼-in. pipe, as in Fig. 2, I mounted it on the ½-in. pipe with a ½- to ¼-in. reducer. When the lubricator was again put back into service it gave no further trouble. A necessary feature of this connection is the 18-in. pipe loop above the lubricator to give sufficient hydrostatic head to insure satisfactory operation.

Riverdale, N. Y. ALEX GRAY

Our Compressor Didn't Stop on Overpressure

RECENTLY WE FOUND our air compressor operating when the pressure was above normal and the air blowing through the relief valve. To stop the unit it was necessary to open the main power switch because pressing the manual pushbutton stop switch would not stop the motor. An inspection revealed that the motor contactor had welded close.



We found that the cause of this trouble was a cavity burned at *X* in the movable contact of the pressure switch. At trip-out pressure the edge of this cavity made momentary contact with the trip terminal to short-circuit the relay coil. The armature of this relay then moved far enough to open contact *A* and break the motor-contactor-coil holding circuit, but not far enough to open the relay's sealing-circuit contact *B*. This allowed the motor contactor to open, but not far enough to break the arc between its contacts before its closing coil was again energized.

An instant later the pressure-switch contact arm moved further toward the trip terminal breaking the contact between the edge of its cavity and the terminal. This removed the short circuit on the auxiliary relay coil and as its sealing circuit *B* was still complete the relay armature was pulled closed and the motor-contractor holding coil was again energized. As the arc on the contactor fingers existed long enough to melt the metal they were welded fast when they made contact.

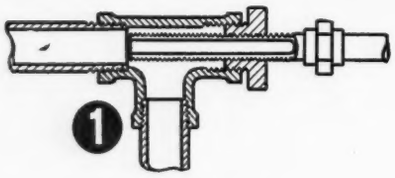
Continued operation under these conditions caused the pressure switch to make good tripping contact, but even

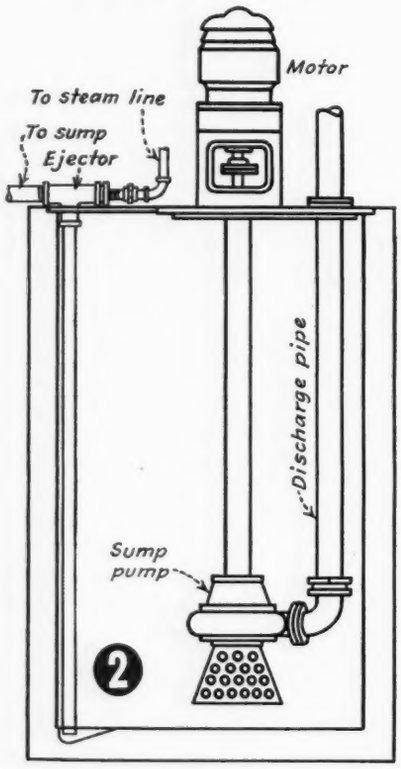
though the motor-contactor holding coil was de-energized the contacts remained welded together which kept the compressor in operation. The pressure-switch contacts were repaired and the contacts *A* and *B* on the auxiliary relay adjusted so that both opened and closed at the same instant. This will prevent a recurrence of trouble.

Philadelphia, Pa. G L Hess

Use Ejector to Empty Sump

We have to clean out our sump tanks occasionally and because they cannot be pumped dry before the workmen start work we rigged up an ejector to do the job, as shown in Fig. 2. For this work we made a steam ejector, Fig. 1, using a pipe tee as shown. The suction pipe of the ejector extends down into a pocket cut in one corner of the sump, so that all liquid can be removed. Discharge from the ejector leads to an adjacent sump. Now if we wish to empty a sump it is only a matter of turning on the steam for a short time and the job is done.





New York, N. Y. P E Meredith

Welded Muffler Deadens Exhaust Noise

Suppression of exhaust impulses from a single-cylinder pumping engine was necessary if the telephones in a nearby field office were to be used satisfactorily, it being impractical, because of other units, to place the exhaust line elsewhere than between the office and pump building. This problem was solved by welding a tee head of 6-in. pipe to the end of the 4-in. exhaust line. The arms of the tee were made practically equal in length, but one end set slightly lower than the other. The lower end was blanked with a welded-in disk, the other equipped with a similar closure in which a number of irregular holes had been cut with the torch.

Effect of the tee was to divide the fast-moving puff of exhaust gases, one portion slightly compressing the charge in the closed end of the tee while the other was dissipated through the holes in the open end. Then, as the compressed portion expanded, it was vented to air, the cycle being completed before the arrival of the next exhaust, but spread over sufficient interval to deaden the impact of the gases on the air, and stifle the sharp bark of the engine to a low-pitched hiss inaudible in the office unless the window toward the muffler was open.

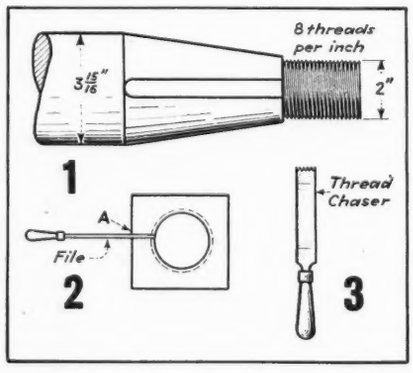
Best results seemed to be obtained when the area of the holes in the disk totalled about half that of the 4 in. exhaust line, and when the individual holes were about 0.75 in. in diameter.

Houston, Texas Charles C Lynde

Repairs Damaged Threads on Large Shaft

In removing a fan from its shaft on a hammer-mill pulverizer we upset the threads on the shaft end, because we had to sledge the puller to loosen the fan from the key. To take out the shaft and clean up the threads in a lathe would have required almost a week. This turned my attention to using a hand-chasing tool, but one could not be located so we made one from an old file. The shaft end, 2 in. in diameter, had 8 threads per inch, which is standard thread for a 1-in. bolt.

To make the chaser, we first cut a 2-in. section from a ½-by 2-in. steel bar and drilled a 27/32-in. hole through it to be threaded with a 1-in. tap. We then cut a slot through one side of the



steel block at right angles to its side and just above the diameter of the hole as at *A*, Fig. 2. This slot was just large enough for the file to fit snugly. We then drew the temper from the file, ground its end to a slight angle to approximately match the curvature of the hole and put the file in the slot so that its end coincided with the side of the hole. The block was then tightened in a heavy vise to hold the file securely in the slot and the hole tapped. This made a tool with the right pitch and thread angle to match those on the shaft. After tempering the chasing tool, Fig. 3, it was ready for use.

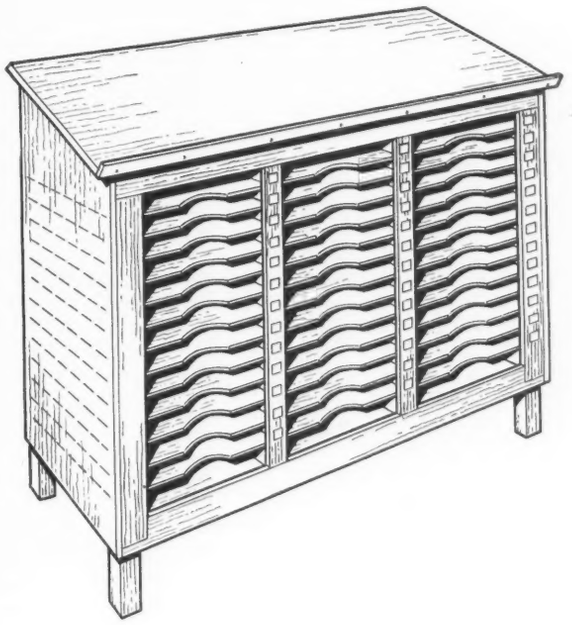
The most serious damage to the threads we removed with a three-cornered file. Then we set up a rest for the chasing tool similar to that used on a hand lathe and while the shaft was revolved at a slow speed we applied the chasing tool to the threads until they made a good fit in the nut.

Goodrich, Ont. G BARRETT

Cabinet for Filing Meter Charts

MANY DIFFERENT DEVICES have been developed for filing and segregating recording-meter charts from power-plant and process operations. My efforts to solve this problem resulted in the plywood cabinet shown in the figure. On the shelves the top veneer grain runs into each compartment to permit easy filing and removing the charts. A circular bite taken from the front of each shelf allows the charts to overhang so that they can be picked out easily. Shelves slope toward the back so that the charts tend to work into the cabinet rather than out. Space at the side of each shelf is labeled to show the records it contains. The cabinet has been made sufficiently high so that its top is a convenient surface on which to compare charts or collected data.

Houston, Texas CHARLES C LYNDE

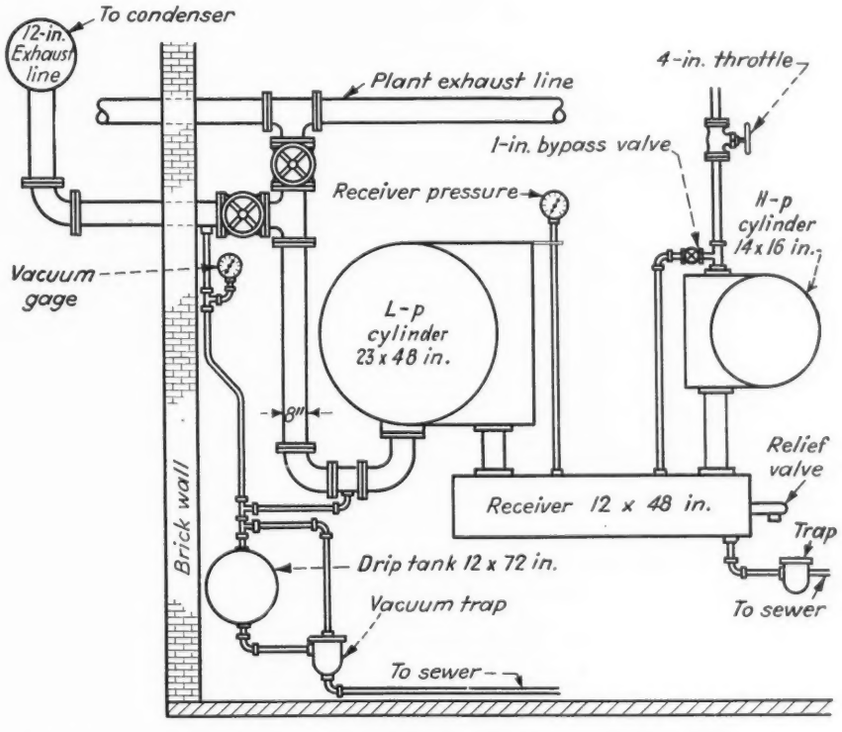


Condensing Operation Cuts Steam Rate 33%

IN OUR PLANT we had to operate a non-condensing compound engine even when a large amount of the exhaust was going to the atmosphere. A condenser used on another unit had sufficient capacity to handle the steam from the non-condensing engine. Connections could be made easily from the exhaust line to the condenser. The required increase in circulating water was available at no other cost than for pumping. The engine has a Meyer valve gear on both cylinders, making it possible to alter the point of cutoff as required for efficient condensing operation.

Everything seemed to be favorable for condensing operation of the engine so I made the changeover. The diagram shows the general piping arrangement. By manipulation of the two valves in the exhaust line from the engine, it may be changed from condensing to non-condensing operation. As a result of the change to condensing operation, the engine runs more smoothly than before, and steam consumption to carry the same load has been reduced about 33% as shown by flowmeter records.

Buffalo, N. Y. R E FONTAINE



Heat Insulation Fights Fires

POWER-STATION and industrial-plant fires are generally small when they start, but may spread rapidly, unless quickly extinguished, because of the combustible material present. Sand is frequently used as a quick and convenient fire extinguisher, or at least a fire retarder. It has, however, the objectionable feature of being an abrasive and has a way of getting into machine parts where it can cause trouble.

As a substitute for sand we use finely ground heat insulation salvaged from boilers and pipe lines. This we keep in buckets just as is usually done with sand. We also saturate old burlap with it to use as fire blankets. Experience with this material has shown it to be just as effective as sand and not abrasive.

Woodford Green, England W E WARNER

How to Figure Beams—No. 4

By PHIL SWAIN

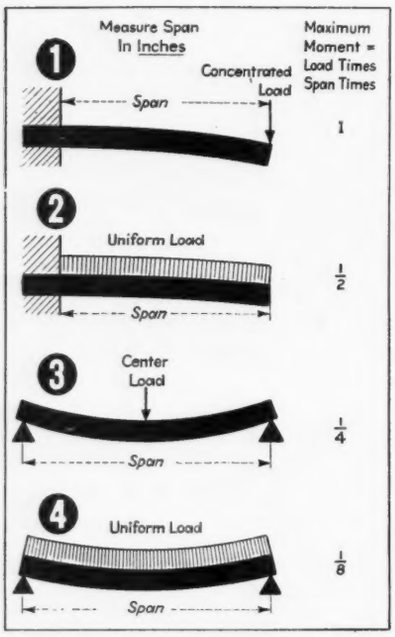


Fig. 1 & 2—Cantilever beams
Fig. 3 & 4—Simple beams

THE ILLUSTRATIONS and table on this page are repeated from last month for further practice. The figures give the formulas for the maximum moments of cantilever and simple beams with concentrated and uniform loads as indicated. The table gives the weight and section modulus of "American Standard" I-beams from 3 to 12 in. deep.

The basic relation between *stress, moment* and *section modulus* can be shown as the following variations of the same formula:

(1) *Moment* = *Stress* × *Modulus*
(2) *Stress* = *Moment* ÷ *Modulus*
(3) *Modulus* = *Moment* ÷ *Stress*

In these formulas, *modulus* ties directly with the beam section (see table). Using Fig. 1, 2, 3 or 4, *moment* can be figured from the span, type of beam, type of load and amount of load.

Most structural codes now permit a maximum unit stress of 20,000 psi in steel beams *under steady loads.* However this stress may not be safely used for slender beams.

For a *simple beam* (supported at both ends as in Fig. 3 and 4) a slenderness ratio above 40 is not permitted unless the beam is braced against side sway. Moreover the permissible stress is customarily reduced about 1.5% for each point of slenderness ratio above 15.

Readers without special knowledge should not attempt to figure unbraced cantilevers with slenderness ratios of more than about 10. The danger of a very slender beam is that it will sway sideways and thus prematurely buckle the compression flange.

Here are some more practical problems to clear up certain points. First take the case where the beam and loading are specified and you want to find out whether or not they are safe.

Problem:—An American Standard 8-in. beam weighing 18.4 lb per foot spans supports 12 ft apart and is loaded at the center with a 5-ton concentrated steady load. Is it safe?

Span is 12 × 12 = 144 in;
Load = 10,000 lb
Moment (Fig. 3) = 10,000 × 144 × ¼ = 360,000 inch pounds
Slenderness ratio = 144 ÷ 4 = 36

This ratio is permissible, but requires a reduction in unit stress of 1.5% for each point over 15, or 21 × 1.5 = 31.5% in all. Then maximum safe stress will be 0.685 × 20,000 = 13,700 psi.

From table, *modulus* = 14.2
From formula (2) actual *stress* = 360,000 ÷ 14.2 = 25,300 psi

Since this is almost double the maximum permissible stress, *the beam is dangerously overloaded.*

Next take a case where you have given beam, span and kind of loading and want to find the safe load.

Problem: In the preceding case what would be the safe load on the beam?

Safe *stress* = 13,700 psi
From formula (1), *moment* = 13,700 × 14.2 = 194,500 inch pounds
From Fig. 3, 194,500 = *Load* × 144 × ¼
Safe *load* = 194,500 ÷ 36 = 5,400 lb

Because of slenderness ratio it often requires some cut-and-try to choose a beam to meet a given condition.

Problem: Select a beam to carry a steady uniform total load of 40,000 lb between supports 8 ft apart (96-in. span).

For first try assume standard 20,000 psi stress. Then, from Fig. 4,

Maximum *moment* = 96 × 40,000 × ⅛ = 480,000 inch pounds

From formula (3) *modulus* = 480,000 ÷ 20,000 = 24.

A 10-in. American Standard weighing 25.4 lb per ft has a modulus of 24.4. However, before selecting it, check the slenderness ratio, which is 96 ÷ 4⅝ = 20.8, or 5.8 points over 15. Unless beam is side braced, this calls for a reduction in stress of 5.8 × 1.5 = 8.7%, so maximum permissible stress will be 0.913 × 20,000 = 18,260 psi.

Required *modulus* is 480,000 ÷ 18,260 = 26.3 so the 30-lb beam (same dimensions) will be safe.

AMERICAN STANDARD BEAMS

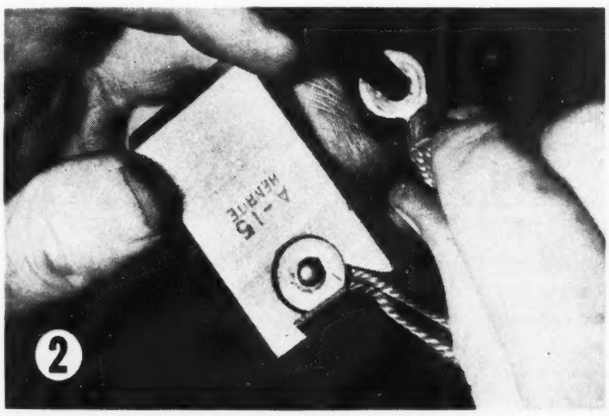
Depth, in.	Nominal width, in.	Weight per ft, lb	Section Modulus
12	5¼	55.0	53.2
		50.0	50.3
		45.0	47.3
		40.8	44.8
12	5	35.0	37.8
		31.8	36.0
10	4⅝	40.0	31.6
		35.0	29.2
		30.0	26.7
		25.4	24.4
8	4	25.5	17.0
		23.0	16.0
		20.5	15.1
		18.4	14.2
7	3⅝	20.0	12.0
		17.5	11.1
		15.3	10.4
6	3⅜	17.25	8.7
		14.75	7.9
		12.5	7.3
5	3	14.75	6.0
		12.25	5.4
		10.0	4.8
4	2⅝	10.5	3.5
		9.5	3.3
		8.5	3.2
		7.7	3.0
3	2⅜	7.5	1.9
		6.5	1.8
		5.7	1.7

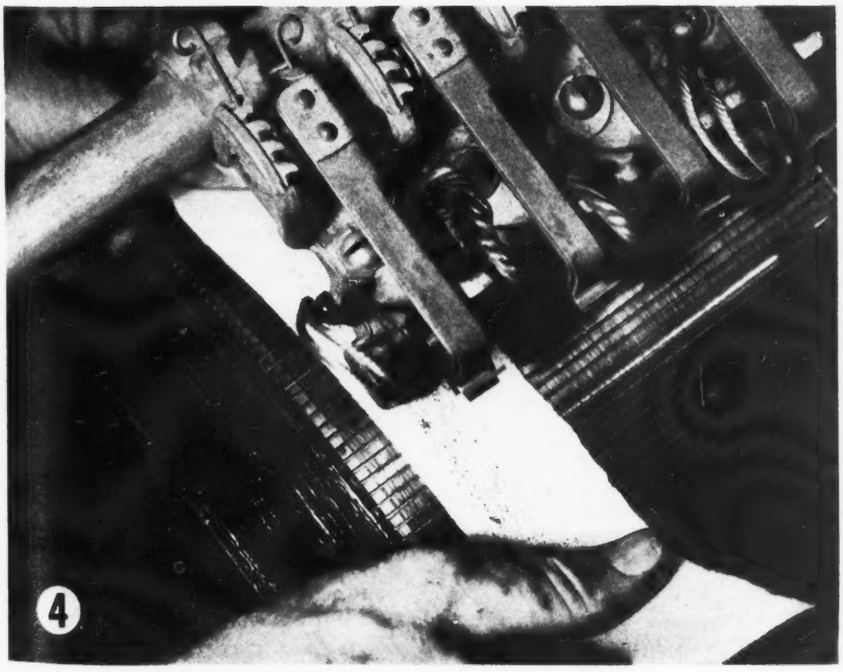
HOW TO INSTALL DC MACHINE BRUSHES

▶ Putting brushes in their holders on a direct-current machine appears to be such a simple job that its importance is frequently overlooked. Neglect of little details when installing the brushes may lead to sparking on the commutator and other troubles later. Cleanliness is one of the most important parts of the job.

After removing the old brushes, thoroughly clean the brush rigging with a cloth. Moisten the cloth with a grease solvent, if this is necessary to get all parts thoroughly clean. Don't forget to clean the inside of the holders so that the brushes can move freely in them

1. Inspect the brush holders inside and out for burned spots that may have been caused by flashing at the commutators. If the inside of the holders shows roughness, remove this with fine sandpaper glued to a flat piece of wood





2. Make sure the brushes have ample-size shunts and are properly secured to the brushes and holders. If the shunt connections are defective current will flow from the side of the brushes into the holders, and cause side burning, wear, overheating and improper brush operation

3. When installing the brushes make sure that they can move freely in the holders. They should not be so loose that there is any appreciable side play; on the other hand they must not fit so that they may expand and stick at operating temperatures

4. Fit the brushes one at a time to the commutator with a strip of sand paper, first using a coarse grade and then a fine one, turned sand side to the face. Then, again thoroughly clean the brushes and holders; then adjust tension springs to about 2 psi to hold the brushes on the commutator

READERS' PROBLEMS

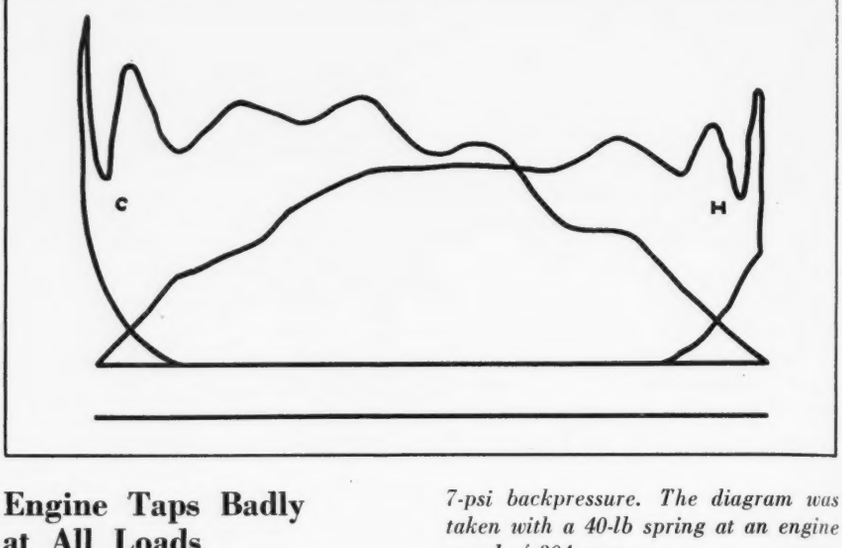
Questions from Our Readers

What Causes Drop In Pump Output?

Question 1

WE HAVE TWO *250-gpm 400-ft-head 2-stage centrifugal pumps, each driven by a 50-hp 3-phase motor, pumping cold water to an overhead tank against a 273-ft head. Each pump has its own intake under a 10-ft positive suction head. A 4-in. Y-connection ties both pump discharges to a 6-in. header.*

When running alone each pump discharges 330 gpm, at a pressure of 150 psi, but when operating in parallel the total water discharge is only 450 gpm at 170 psi. The total head, including friction, is slightly under the rated figure and we are unable to determine why the pumps do not discharge full capacity when operating in parallel. Could it be caused by unstable pressure characteristics affecting the spring-operated vertical check valves?—FBP



Engine Taps Badly at All Loads

Question 2

MY 4-CYL ANGLE *steam engine has a tapping sound in one cylinder at all loads. The noise appears to come from the 12x14-in. vertical cylinder supplied with 80-psi steam and operating against 7-psi backpressure. The diagram was taken with a 40-lb spring at an engine speed of 304 rpm.*

This particular cylinder was recently bored and rebushed. End clearance is ¼ in. I have checked all bearings, piston, piston rod and crosshead and cannot find any trouble that would cause this noise. Can POWER *readers advise me what adjustments are needed?—GEB*

What Makes Meter Swing?

Answers to Aug Question 1

The Question

WE HAVE A 4-CYCLE *5-cylinder 550-hp 225-rpm diesel engine direct-connected to a 350-kw ac 2300-volt generator. Some five years ago the crankshaft broke and a new one was installed. I am informed that the new crankshaft came with only five counterbalance weights instead of ten as on the original shaft. At this time the firing order was also changed from 1-3-5-2-4 to 1-3-5-4-2.*

Since changing the order it has been noted that the wattmeter fluctuates from 100 to 300 kw every few seconds; the power-factor meter also swings from .70 to .90. This swinging or hunting occurs when the engine is on the line either alone or in parallel with other engines. This condition is not noted when the other engines in the plant are on the line alone, with the engine in question off the line entirely, which indicates that the trouble is not related to the plant load.

Efforts have been made to correct the condition but to date they have not been successful. The governor appears to be in good order and no trouble has been found with the voltage regulator on the generator in question.

Would the change in firing order have this effect on the engine or could it be caused by unbalance of the crankshaft, or both? The engine does not appear to run rough or out of balance nor do the fluctuations appear to affect the general running of the engine.—EME

Pump Valves Are Not Seating

THE TROUBLE MIGHT BE CAUSED by faulty fuel-pump or sticking fuel-injection valves. The fuel-pump valves might be sticking, the valve springs may be broken, or the valves may not be seating properly; if not too badly worn they should be ground in. I have found that Clover 2-A compound followed by Carborundum H-40 Medium, and finished with Carborundum H-40 Fine produces a very good seat. After being ground, the parts should be thoroughly washed with kerosene.

If fuel-injection or pump valves are sticking they may be cleaned with Bon Ami or lapped in with the Carborundum H-40 Fine compound. The fuel-pump suction valve is more likely to be causing trouble than the discharge valve.

The fuel-pump gaskets, if old or hard, should be annealed and the valve cage tightened.

Marshall, Mich. C W JENNINGS

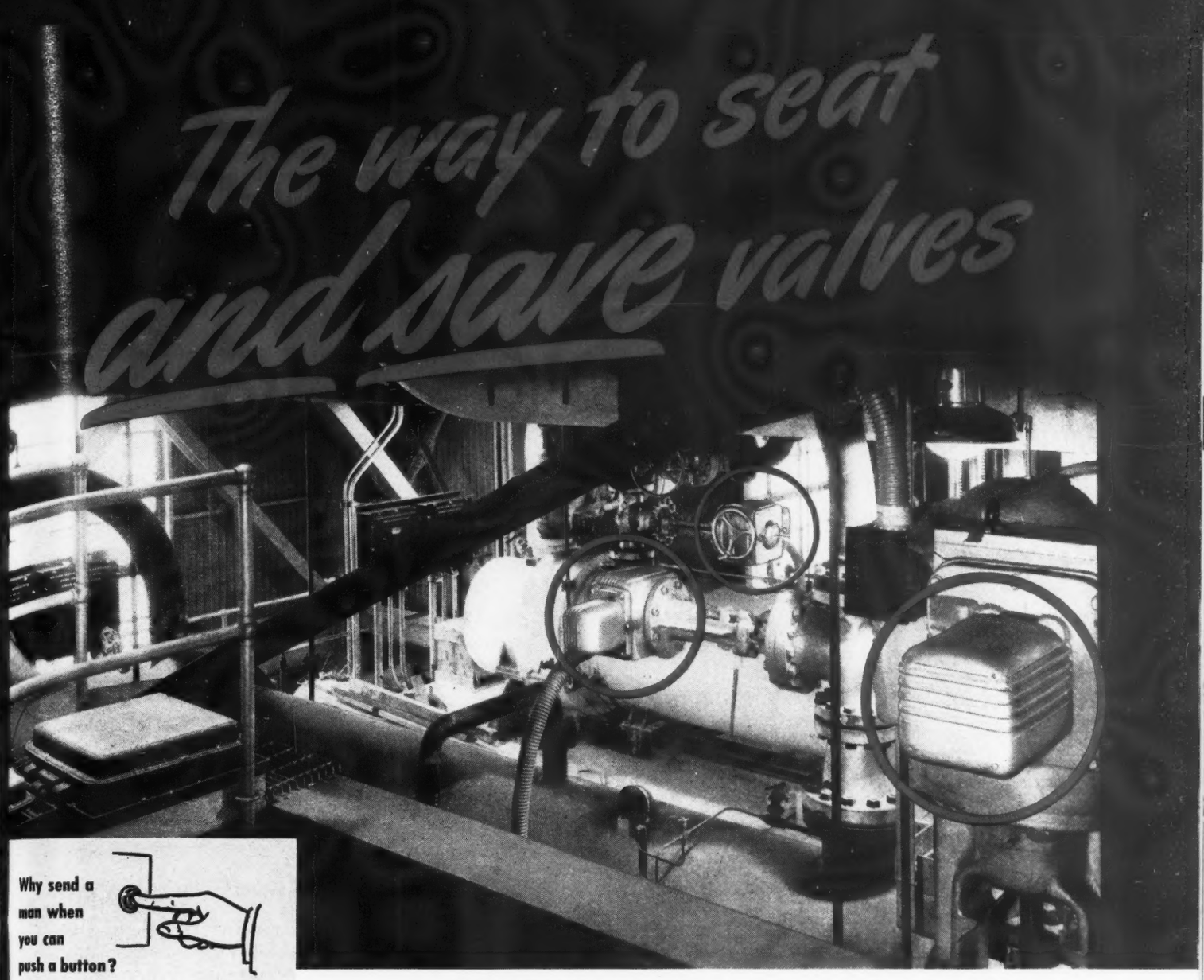
Change the Injection Sequence

THE WATTMETER FLUCTUATION described by EME is caused by torsional vibration of the shaft, transmitted by the alternator and indicated at the various switchboard instruments.

His problem reminds me of a similar condition, where the injection sequence of a 4-cycle 12-cylinder diesel was changed. Such manipulation should not be done without considering the crankshaft and camshaft relation. The latter actuates the intake and exhaust valves of the engine, and the injection sequence or firing order is controlled by the camshaft and crankshaft arrangement. Fortunately EME, with that firing-order

(*Continued on page* 122)

The way to seat and save valves



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change, did not encounter more serious trouble because of the low engine speed, and perhaps only partial load carried by the engine. Torsional vibration could be so violent as to wreck the engine.

As to the crankshaft counterweights, these can cause unbalance of the reciprocating and rotative parts, but not to such an extent as stated by EME. I should like to suggest an immediate change of the injection sequence to the proper cam arrangement.

CARL BACHMANN
Schenectady, N. Y.

Is Crank Throw Correct?

THE ANSWER to EME's question is undoubtedly in the design of his particular engine. An engineer representing the manufacturer should be called on to check installation and performance for the following items.

1. Aside from the difference in the number of counterbalance weights, does the present crankshaft differ in design in any other manner from that previously used? Are the crankthrow positions identical for the two shafts?

2. When the firing order was changed were valve and injector timings also corrected?

If, after proper checking, it is found that the two shafts are identical except for the number of counterbalance weights, the trouble is undoubtedly caused by the change in cylinder firing order. This can be seen by referring to Fig. 1 where the original firing order of the engine is outlined. Unlike a 6- or 8-cylinder engine, no two crankshaft throws occupy the same relative position on a 5-cylinder engine. In the latter engine each throw is 72 deg apart. Consequently, changing the firing order as noted above would result in late firing of the No. 2 cylinder, if it fired at all, accompanied by loss in shaft power. This condition would have a tendency to overload cylinder No. 4, and could account for the fluctuation in generator power as observed.

It may be found, however, that the new crankshaft is so designed as to permit use of a 1-3-5-4-2 firing order. Such a shaft would have the No. 2 and 4 crankthrow positions reversed from the previous shaft used, as outlined in Fig. 2. If this is the case, a check to see that valve and injector timings have also been changed to meet this condition should be made.

It is desirable to have the power impulses equally spaced, and this has led to certain conventional arrangements of crankshaft throws. In this respect the 1-3-5-4-2 firing order would be better than 1-3-5-2-4.

Mt. Vernon, N. Y. BRIAN CORRIGAN

Meter Wiring or Connections

ANY DISTURBANCE caused by a change in firing order or by unbalance of the crankshaft would occur at intervals of one or two revolutions rather than every few seconds. If the variation from 100 to 300 kw represented an actual load, caused by faults within the set, the engine speed would vary or at least the governor would operate excessively. Also in a period of five years, mechanical faults giving such a variation would develop to the extent that normal operation would be impossible. The fact that operation in parallel with other units is normal indicates satisfactory speed and voltage regulation. If the variations were caused by fluctuations in generator frequency they would disappear when the unit was operated alone.

Presumably both meters affected have current coils connected to the same shunts. Examine shunt bars and contacts carefully, using a millivoltmeter with picks to check contact losses. Check for vibrations at shunt locations.

If possible interchange meters with those from an engine set operating normally. If this is not possible check wiring of current and voltage coils for method of connection, and for open or short circuits. Check vibration at meter locations and also shielding of meters.

If meters are definitely in good condition, check engine speed with a tachometer sufficiently sensitive to follow variations of the order noted. Check exciter voltage and current for variations. Check generator regulator contacts and coils for faults, using an insulation resistance test on all coils.

Since the condition has persisted for five years without developing further and since operation is normal in other respects it is probably caused by faulty meters or connections.

St. John, N. B. C G CLARK

A Job for the Meterman

EME's STATEMENT that the governor appears to be in good order, and that the engine does not appear to run rough or out of balance would seem to indicate electrical wiring trouble. Probably a loose connection or broken wire is affected by the vibration of this particular engine. If the meters are in the zone of vibration, then there is also the possibility of a loose connection in the current element wiring or within either meter.

Duluth, Minn. G I SMITH

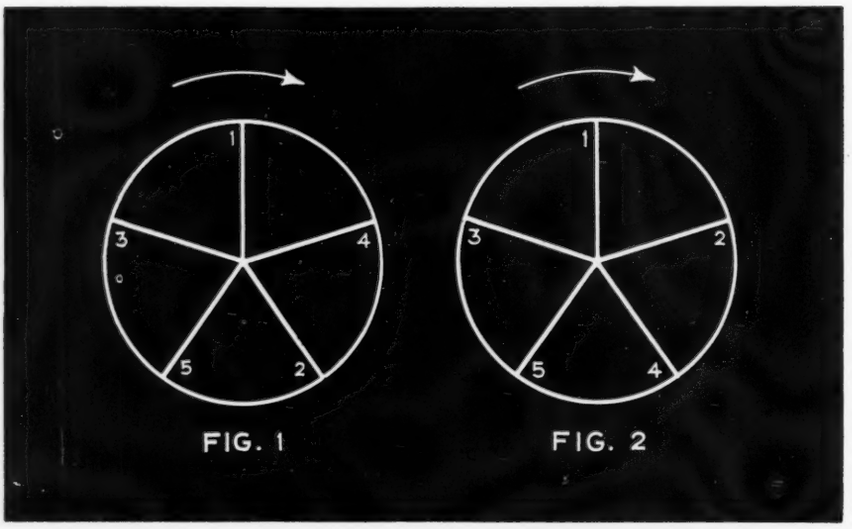

FIG. 1 FIG. 2

New Crankshaft Not the Cause

THE PROPER THING for EME to do to correct the trouble would be to change the firing order of the engine back to the original order, since all the trouble appeared after the change was made.

It would be impossible to change the firing order of this engine to 1-3-5-4-2, with the cranks advancing 72 deg each from 1 to 5 in counter direction to engine rotation. If EME will check the firing order, he will find it to be: 1-2-3-5-4, or 1-3-4-5-2, which naturally

(*Continued on page* 124)

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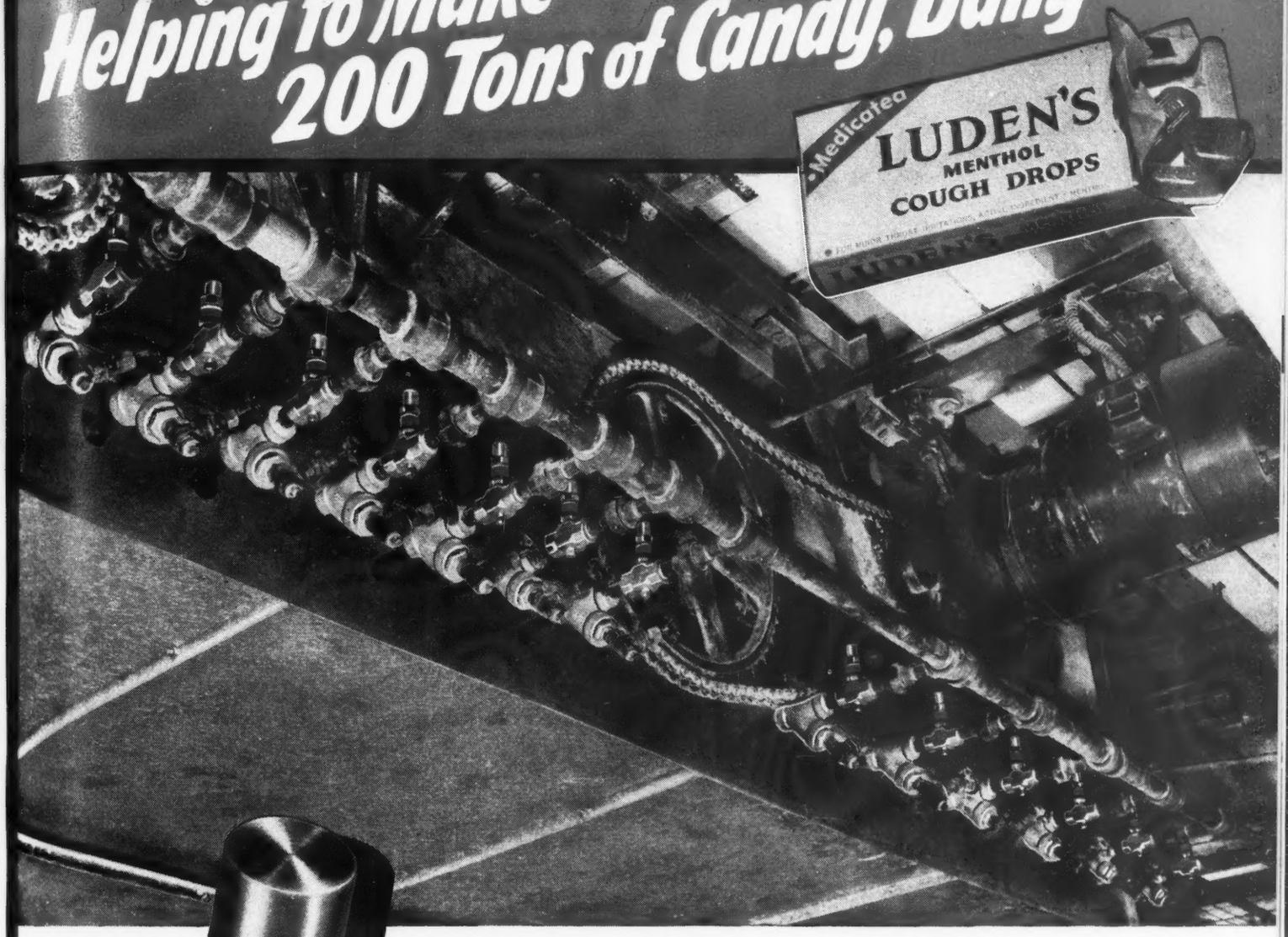

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The picture shows thirteen of these Traps, individually draining each of the heating coils of a starch conditioner. The chief engineer reports: "After three years of service, without attention, these Traps are still keeping this *dryer* at peak efficiency". Other YARWAY IMPULSE TRAPS are in use on cooking kettles, vacuum cookers and other process equipment at this plant.

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makes an unbalanced condition from piston effort, but which is partly corrected by the inertia of the flywheel.

To change the firing order from 1-3-5-2-4 to 1-3-5-4-2 it would be necessary to change the setting of the cams on either No. 2 or No. 4 cylinders. If the cams of No. 4 were advanced 180 deg, this would cause No. 4 cylinder to fire between No. 3 and No. 5, and if the No. 2 cams were backed up 180 deg, then No. 2 cylinder would fire between No. 1 and No. 3.

It is difficult to understand why the change in firing order of this engine was made, as the order of sequence of the cranks alone determines the firing order of the cylinders and any deviation from it would cause trouble.

I feel certain that the manufacturer of this engine who furnished the new crankshaft, with only five counterbalances instead of ten, still knew what he was doing and that the new shaft would perform its duty successfully if the engine was not tampered with in any other way.

Clarkdale, Ariz. FRANK AVIS

Look for Electrical Trouble

CHANGING THE FIRING ORDER of EME's engine or the change in the counterweights on the new shaft would not be a cause of the trouble he describes. The manufacturer's engineers probably had all technical and practical problems in connection with these changes worked out to their satisfaction.

Assuming the engine governor and the alternator voltage regulator are functioning properly and the engine appears to be operating more or less smoothly, a periodic or momentary shifting of the engine and alternator load, when the unit is on the line in parallel with other units, would likely be caused by one or more faulty fuel pumps or fuel-injection nozzles causing a cylinder to misfire occasionally. Under such conditions misfiring will cause a sudden momentary dropping of load, the violence of this disturbance depending largely upon the flywheel effect of the rotating element of the unit.

If the governor is not functioning properly, but has a tendency to hunt, this will cause the unit to pick up and then drop its load when paralleled with other units; in this case the fluctuations would probably be more gradual and not instantaneous, as in the case of a misfiring cylinder. This governor hunting should be noticeable to an operator familiar with the sound of the unit as should a misfiring cylinder, especially if the exhaust can be heard.

That the unit should drop and then pick up load at intervals of a few seconds, when running alone, is contradictory in view of EME's statement that these fluctuations do not affect the general performance of the engine and that the governor and alternator voltage regulator are functioning properly.

A change in speed or voltage to produce the effects noted on the switchboard instruments would surely be noticeable in the sound of the engine or in lamps or motors connected to the alternator circuit.

Since the load fluctuations do not seem to affect the general running of the engine, I am inclined to suspect the load on the unit is not actually fluctuating. I would suggest he carefully examine the wiring of the wattmeter and power-factor-meter circuits, including the internal connections of these instruments. Building vibration and a loose connection would open an instrument circuit and cause an indication of load fluctuations that did not actually exist.

Clayton, N. M. J H BENDER

Change in Firing Order is Responsible

IT IS UNUSUAL that EME's condition should have existed since the new shaft was installed five years ago. However, the first thing to do is to have a set of cards taken on the engine to determine the behavior of each cylinder.

It seems unlikely that the new shaft has the same relative crank positions as the old one and yet the question of changing back to the former firing order would seem to imply that this is so. In this case I would say that the trouble is caused by the change of firing order.

There being five working strokes in every two revolutions we must have the firing points set $\frac{360 \times 2}{5} = 144$ deg apart.

If the new crankshaft is the same as the old one this balance is upset, as shown in the accompanying diagram. Was the shaft tested for static balance before being installed? The unbalanced condition may be partly offset dynamically and statically by having five weights in place of ten as before.

This would certainly cause the abnormal swing of the kilowatt meter and the only reason the unit gives anything like reasonable service is because the governor is in good condition.

Kearny, N. J. GEORGE MCNALLY

Study Pyrometer Indications

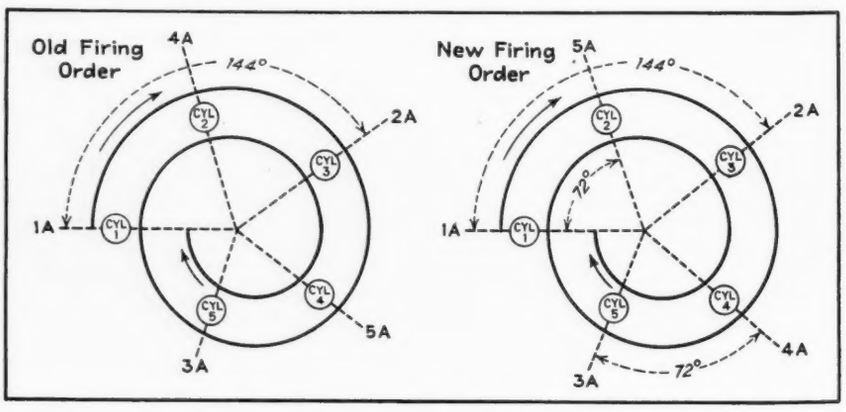
EME STATES that since the firing order was changed, fluctuations of the wattmeter and power-factor meter have been noticed.

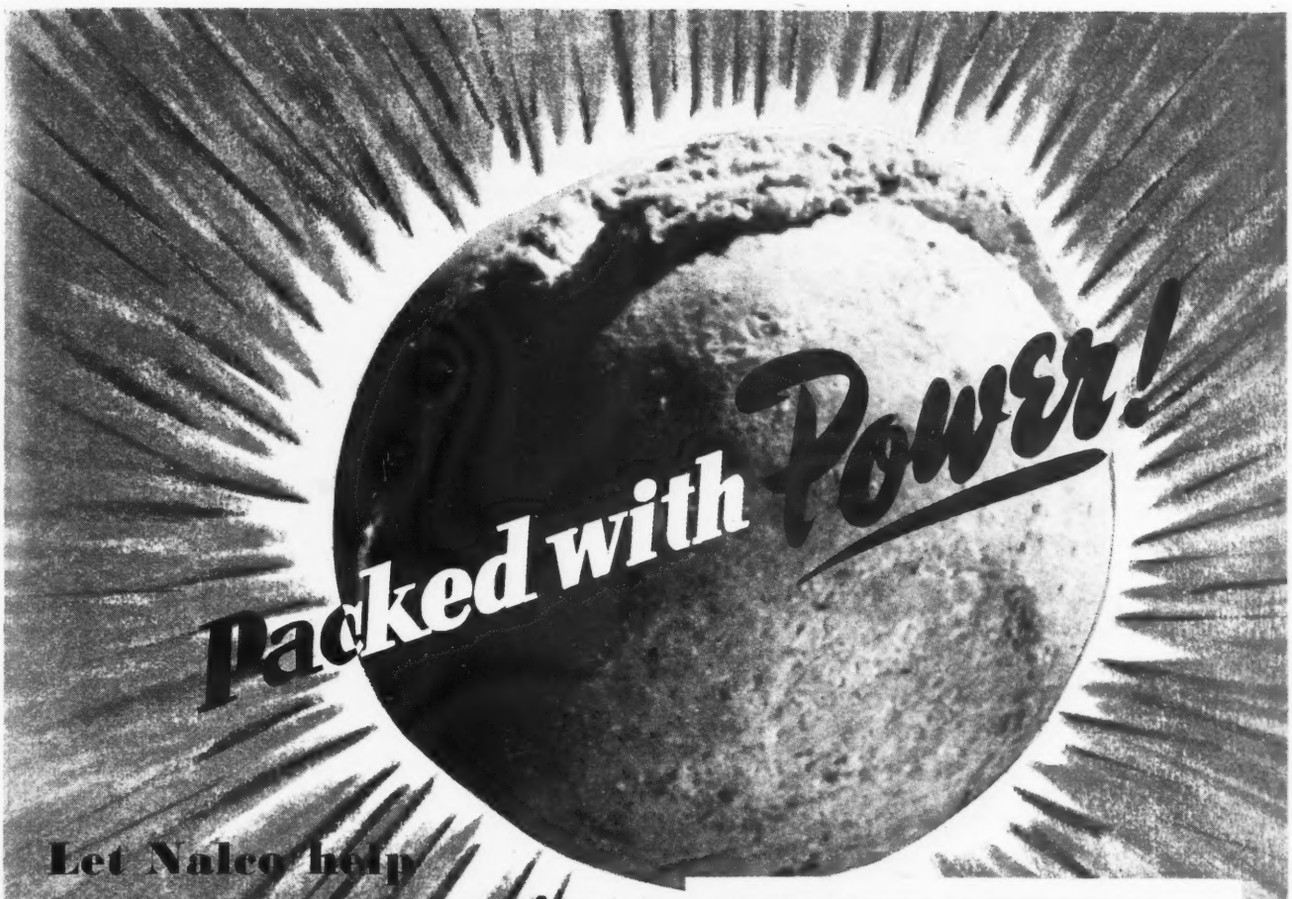
I would change back to the original firing order to see if the swinging condition still existed. The disturbance can be caused by either the firing order or counterbalances. Ten weights will produce smoother operation than five and to secure the original smoothness may require changing the shaft. Operating an electric generator from a diesel requires a well-balanced running unit so that electrical variations are kept at a minimum.

If the trouble is not in the firing order and if the governor and voltage regulator are in good condition the trouble must be caused by the counterbalance.

If the engine cylinders are equipped

(*Continued on page* 126)





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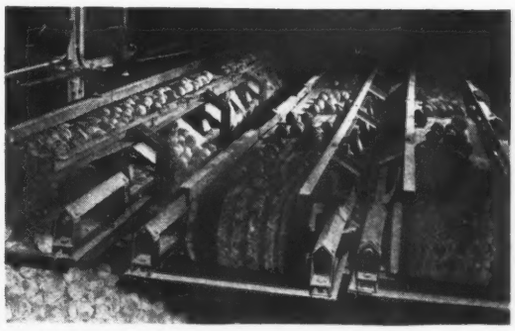

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Philadelphia, Pa. W T MULLEN

How And When To Pin Piston Rings

Answers to Aug Question 2

The Question

A QUESTION HAS COME UP *concerning internal-combustion engines about which we would like some advice. Which side of a piston ring is considered the correct one to place pins when they are used to keep the rings from turning? What size rings are customarily pinned? Is this practice recommended?—BAO*

Pins Prevent Port Clipping

I WOULD LIKE TO POINT OUT that the practice of ring pinning is often necessary to prevent port clipping in 2-stroke-cycle diesels, and for this purpose is to be highly recommended. When a minus circular ring is too narrow to fill out the groove, it is sometimes pinned across the joint to prevent the ends from fluttering. (see sketch ring *A*). If a cylinder is worn out of round, either plus or minus circular rings are sometimes pinned with their longer diameters in line with the longer diameter of the cylinder. This is to prevent blowby. However, the main reason for pinning is to keep the joints of the usually plus circular rings from expanding into and clipping the wide ports of the 2-cycle diesel as at *y*.

Ring size, unless very small, is usually immaterial. Pins are placed on the pressure top side as at *B*, because if applied on the bottom as at *C*, they might wedge the ring away from the groove land, and the pressure, acting on the pin, might break the ring, as shown at *x*.

Menard, Ill GEORGE HOLMAN

Ring Gaps Form a Channel

ON 250-HP AND LARGER diesels the rings are generally pinned. On smaller internal-combustion engines expanding rings are placed behind the piston rings.

If the larger engines are not equipped with dowel pins trouble will be experienced from ring rotation. The ring gaps will form a channel between the piston and cylinder, allowing leakage of gas responsible for the carbonizing of rings and valves. It is a good idea to install dowel pins or other means to prevent ring rotation. They should be installed or fitted in the bottom of the groove or on the lower lip of each groove, one pin to each groove.

The top ring gap may be at any point as this is the start for laying out a piston with four rings having No. 1 as a starting point, No. 2 at 180 deg, No. 3 at 90 deg. No. 4 at 270 deg. This gives an equal distribution around the piston.

Philadelphia, Pa. T F CUNNINGHAM

Keep Ring Gaps Out of Line

WHENEVER PINS ARE USED to keep the rings from turning in their grooves, they should be installed on the upper side of the ring. The reason for this is that when the piston is moving up on the compression and down on the power stroke, the pressure of compression and that of the power stroke forces the rings downwards against their lands. Therefore the rings will not be forced against the pins. If the pins were installed on the lower side of the ring the forces against the rings would break them.

Retaining pins are only necessary on engines that have ports for the inlet or outlet of gases instead of valves. When the cylinder walls have ports the pins keep the rings from turning where the ends might catch in the port openings.

When pins are installed, they should be spaced to keep the ring gaps from being directly above each other.

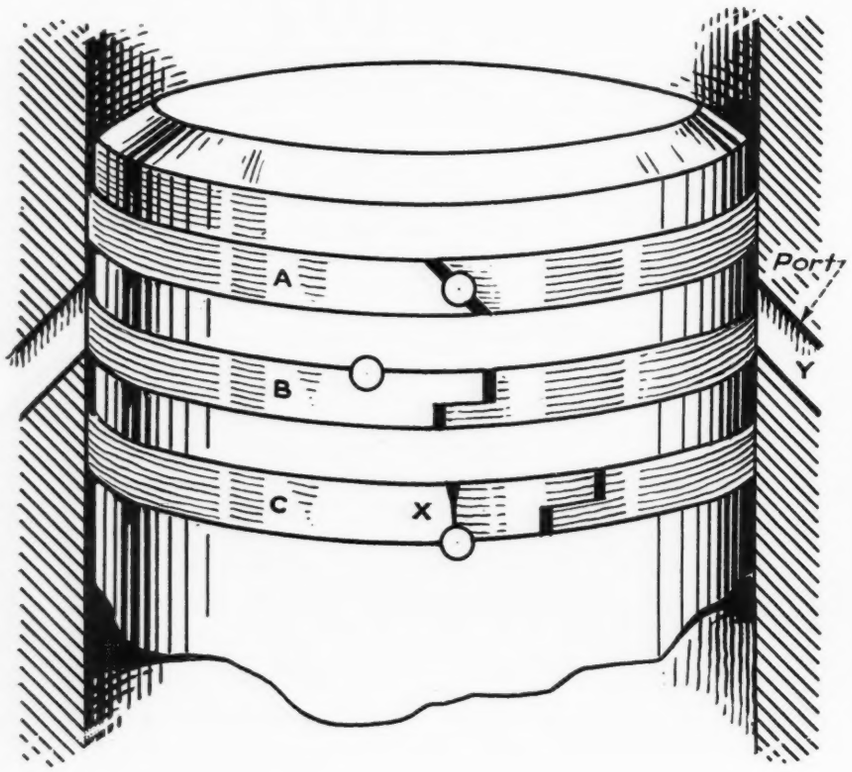
Bismarck, N. D. LESLIE BRADLEY

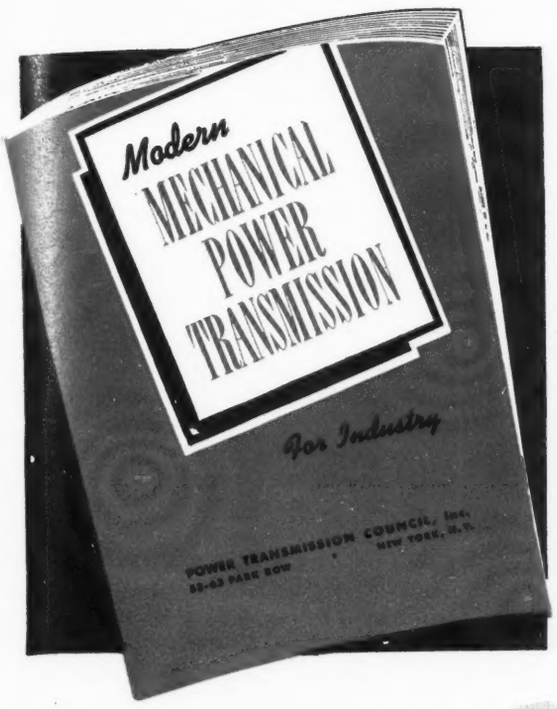
Removing Pins Eliminated Trouble

THE ANSWER to BAO's question is to pin the rings at the butts; double-seal rings have a slot for the pin.

In one power plant there were four 2000-hp diesels, using a high Baumé gravity fuel, direct-connected to generators. Considerable trouble was caused by the piston rings becoming carbonized in the piston grooves. We removed the pins and eliminated the trouble, because it gave the rings more freedom. This was more noticeable when super centrifuges were installed for the fuel oil. The pistons operated longer, and it was noted that the rings which were not pinned were in a better condition than the pinned piston rings. We then decided to remove all the pins.

Grand Rapids, Mich. J M GORRIE





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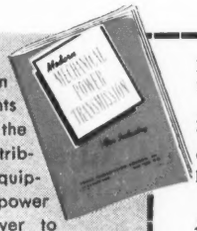

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ARGUMENT CORNER

SAWDUST MOUNTAIN PORTLAND'S ANSWER TO FUEL SHORTAGE

This pile, outside Portland General Electric Co's Station L (see POWER, Feb, 1940, pg 68) represents the heat equivalent of 430 carloads of oil. Called "Mount Osborne", after PGE's general superintendent C P Osborne, this sawdust mountain has been built to the unprecedented height of 142 ft (12 million cubic feet) to permit Station L to carry a major part of its load on hogged fuel and thus save precious oil.

All Right – Let's Argue

GEORGE HOLMAN, of Marissa, Ill., writes that he finds POWER of general interest but would like to see more live-wire engineering discussions in this *Argument Corner*. All right, let's argue; it's a good idea! Also, let's confine the argument to matters of practical interest to practical engineers—and let's be brief.

Among his suggested topics are: Which is handier for welding around the power plant, oxacetylene or arc? Is it better to run motors at 220 or 440 volts? Where is it best to use a reciprocating pump and a centrifugal pump?

Are these matters worth debating or have you any other suggestions?

PHIL SWAIN

Add Adjustable Scale To Spirit Level

In recent numbers of POWER, readers have told how they have improved a spirit level by an attachment on its end to measure the amount of out-of-level. I would like to add my design, shown in the figure, to the others. As can be seen I milled a groove in the end of the level, wide enough to take a section of steel scale. The sides of the groove are slightly undercut and the edging of the scale beveled to fit. This locks the scale in place so that its end cannot be bent outward.

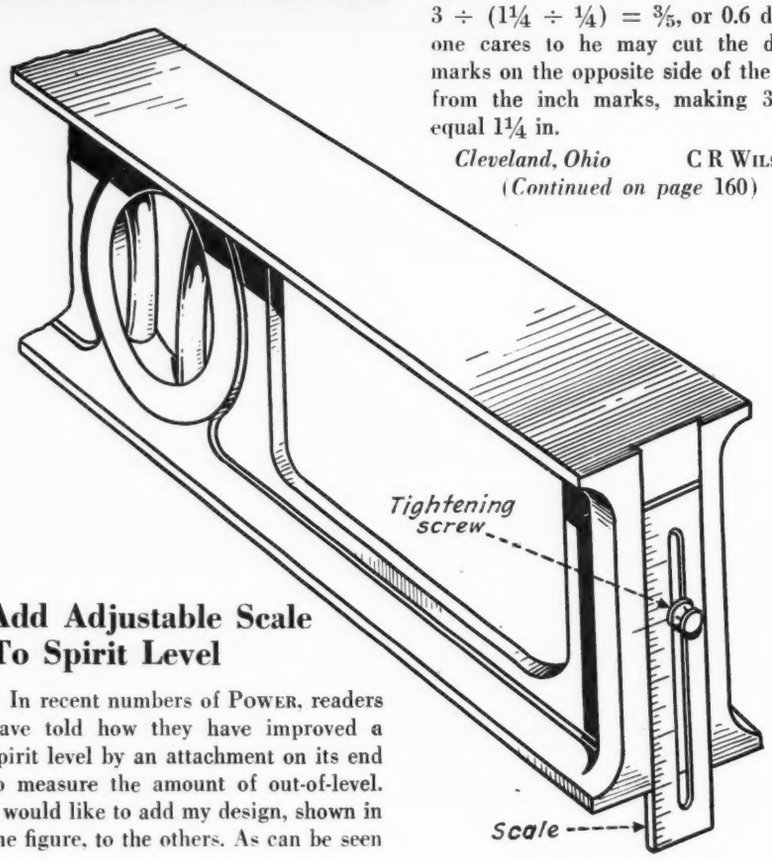
To complete the job I cut a slot in the center of the scale and tapped the end of the level for a thumb screw to secure the scale in place. This scale, having a length equal to the depth of the level, can be pushed into the clear and secured in place where it does not interfere with the normal use of the level.

To measure the amount of out-of-level, I loosen the holding screw, set the level and scale and then tighten the screw to hold the scale at the setting. The level is 2 ft long so that if the scale shows $\frac{5}{8}$ in., the out-of-level per foot is one half of this or $\frac{5}{16}$ in. If the beam or other object to be leveled is 12 ft long then it is $\frac{5}{16} \times 12 = 3\frac{3}{4}$ in. out of level. In my arrangement of the scale its movement is limited to about 1 in. This, however, is not a serious objection, because there are few cases where you want to measure out of level exceeding 1 in. in 2 ft.

To extend the usefulness of the level remember that a 2 ft level showing $1\frac{1}{4}$ in. out of level indicates a slope of 3 deg. From this any other slope may be figured. For example, if the scale shows $\frac{1}{4}$ in. out of level then the slope is $3 \div (1\frac{1}{4} \div \frac{1}{4}) = \frac{3}{5}$, or 0.6 deg. If one cares to he may cut the degree marks on the opposite side of the scale from the inch marks, making 3 deg. equal $1\frac{1}{4}$ in.

Cleveland, Ohio C R WILSON

(*Continued on page* 160)



ECONOMICAL, RUSTPROOF, DEPENDABLE

Copper Tubes demonstrate their effectiveness in all-out industrial production

Anaconda Copper Tubes not only are completely immune to rust and stubbornly resistant to corrosion, but they also offer least resistance to flow because of smooth interiors, thus reducing pumping costs. They save space.... they're easy to bend....easy to install with solder or flared-type fittings.... and highly adaptable to varied layout requirements.

Many operating men in war vital plants foresaw the severe demands this titanic production program would place on ordinary equipment like pipe lines and used very good judgment when they installed Anaconda Copper Tubes. Today, except for vital war plants, it is not possible to purchase Copper Tubes for pipe lines or any other industrial use, but for future reference write us for a copy of Publication C-24, "Anaconda Copper Tubes for Industrial Applications".

4247A

Anaconda Copper Tubes

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Co. • In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

POWER LINES

POWER Wins Two Editorial Awards

POWER received two "Awards of Merit", in *Industrial Marketing's* Annual Competition for Editorial Achievement at the September 14 dinner program of the Industrial Advertising Association of New York.

Both citations covered material published during the year ending July 31, 1942. One award, for excellence of illustrative treatment of editorial material, was granted for the 32-page special section, "Handbook of Feedwater Treatment", which appeared in December, 1941, POWER. The other, for quality in an issue of special purpose, was based on the September, 1941, number featuring the section titled, "Power for the Battle of Production".

POWER, in 1941, was honored with another award of merit for excellence in illustrative technique, based on the special section, "Oil & Gas Power, 1941", published in the June, 1941, issue.

The photograph shows P W Swain, editor, receiving one of the awards from Charles M Neighbors, advertising manager, Babcock & Wilcox Co, one of the judges of this year's contest.

Portable Power for Navy Outposts

The photograph below, left, shows one of the Navy's new portable powerplants as set up and in use by the Navy's new construction battalion, the "SEABEES". These units are being used to provide power in a hurry for the construction of the new mobile fleet and air bases now being constructed under the direction of the Bureau of Yards and Docks in the combat areas outside the continental limits of the United States. These power units are installed, repaired and operated by electricians enlisted in the Navy's new "SEABEES" program.

The unit shown is an International Diesel which furnishes the power for International TD-18, and is a 100-hp unit with a 50-kw generator. Experienced linemen and stationary electricians are enlisted for this purpose at advanced ratings of Chief, 1st and 2nd class petty officers.

There are more than 50 of these construction battalions being recruited and received at the training stations throughout the country, where they remain for indoctrinal training.

The "SEABEES" battalions are made up of Naval and enlisted men (reserves) who are skilled mechanics, electricians, carpenters, divers, steel workers, pipe fitters, blacksmiths, etc. Ratings for these enlistments range from Chief Petty Officer down to Seaman, second class.

All-Out Scrap Drive Yields 100,000 Tons

By scrap-collection drives and intensified salvaging activities, the Westinghouse Electric & Mfg. Co has saved 100,000 tons of strategic war-needed materials in the past year, according to Ray Schmidt, supervisor of the Westinghouse Reclamation and Salvaging Department.

(Continued on page 196)

ASK YOUR BOILER TO MATCH THIS RECORD

Such performance is not unusual with Coppus-Dennis Fanmix Gas Burner on natural gas.

Gas and air are combined in a perfect mixture by the exclusive "pinwheel action" described in Bulletin 410-3.

Ratings can be increased, as Fanmix gives more heat release per cubic foot of furnace volume. Maintenance of tubes and furnace linings is reduced due to discharging "radiant heat" and uniform temperature inside whole furnace. There are no drifting "hot spots." Check the coupon for the bulletin which describes many other advantages of this new "Blue Ribbon" product.

COPPUS

ASK YOURSELF:

"WHICH IS THE BETTER BUY FOR A SMALL LOAD?"

For 150 HP and down, the answer is Coppus "Blue Ribbon" Steam Turbine.

From Coppus you can get six frame sizes-smaller than are included in most lines. Keep your investment proportional to the load — specify Coppus.

It's a "Blue Ribbon" product, so you can expect trouble-free performance. Reason why described in Bulletin 135-9.

COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

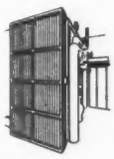
COPPUS ENGINEERING CORPORATION

330 Park Avenue, Worcester, Mass.

Sales Offices in THOMAS' REGISTER. See Sweet's Catalog for other "Blue Ribbon" Products.

You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

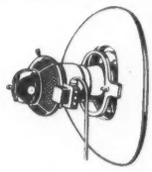
(Check the ones you want)



☐ Coppus Unit Air Filters. For industrial ventilating and air conditioning systems. Bulletin F-320-5.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.

☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.



☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Welding Exhauster. For exhausting welding fumes and other injurious gases from confined working spaces. Bulletin 168-1.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

☐ Coppus Steam Turbine (described in this ad).

NAME.....

COMPANY.....

ADDRESS.....

ENGINEERS' BOOKSHELF

Water Treatment

WATER HANDBOOK—*Published by W H & L D Betz, Gillingham and Worth Sts, Frankford, Phila., Pa. 64 pages, spiral bound, 8½ x 11 in. Price 50 cents, postpaid.*

A complete handbook on industrial and municipal water, in two sections, "Water Analyses" and "Interpretations." In the first section, 25 different methods of water analyses are discussed at length, with procedures and calculations. Such water analyses as hardness, alkalinity, phosphate, sulfite, turbidity, oil, calcium, specific conductance, etc, are covered. With but one exception, all tests are simple accurate determinations requiring little or no previous chemical background. Bacteriological analyses are not included.

The second section of the book is devoted to interpretations of the tests and their application to plant control. Included here are discussions of such subjects as carbonate and non-carbonate hardness, pH control, steam purity, inter-crystalline cracking, corrosion and many others.

Scattered throughout the water handbook are 16 useful technical graphs and 15 illustrations of different pieces of testing equipment. The book fills a long-felt need of power-plant executives, operating engineers, plant chemists and anyone else interested in water.

Welding

THE SCIENCE AND PRACTICE OF WELDING *By A C Davies, member of the (British) Institute of Welding. Published in Cambridge, England, at the University Press and in New York by the MacMillan Co, 60 Fifth Ave. 436 pages, 5 x 7 in., illustrated, cloth bound. Price $2.25.*

A practical British book that starts at the very beginning by explaining what happens to metals when heated and ends with the technique of welding aluminum and magnesium alloys. The author takes time to cover the many sidelines a welder should know to understand the actual process of welding. These include some of the principles of physics, chemistry, metallurgy and electricity as they affect welding. He assumes no previous knowledge of these subjects on the part of the student welder. Brief but specific chapters

(*Continued on page* 184)

". . . . we joined the women's motor corps as you suggested, dear. Next Sunday we're going to see if we can put it back together again."

Changing your address soon? • • •

You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

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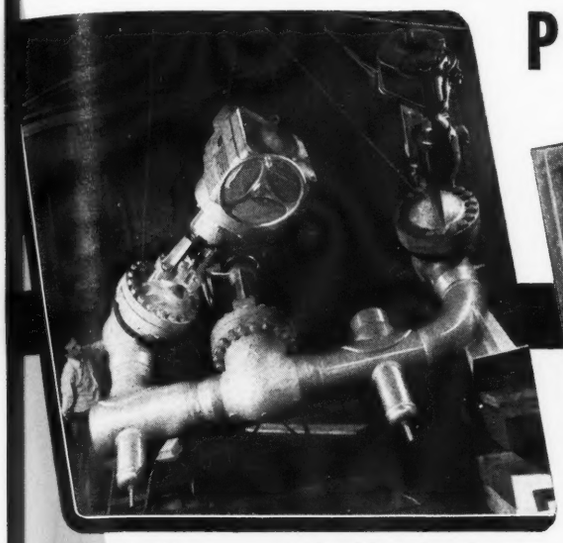
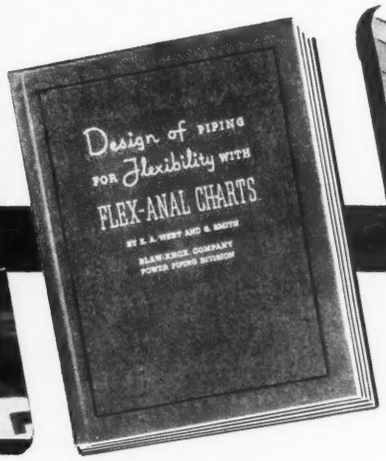
(Send to Circ. Dept., POWER, 330 W. 42nd St., New York, N. Y.)

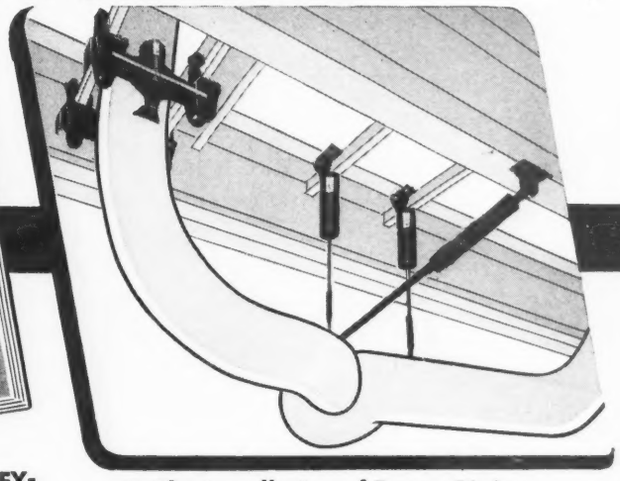
POWER PIPING DIVISION recommends this scientific approach to your PIPING PROBLEMS



● The use of highly developed procedures employed by Power Piping Division which provide the ultimate in pre-fabrication and erection of your piping systems, with the utmost economy.

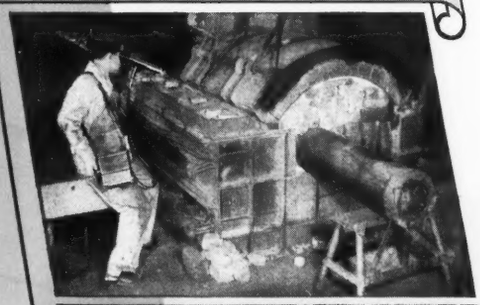


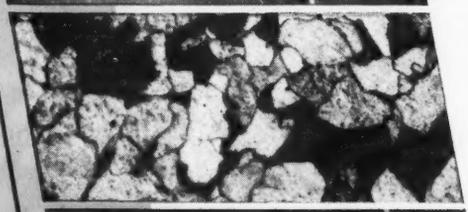
● The employment of FLEX-ANAL CHARTS which permit your engineers to simplify and quickly arrive at an economical design.

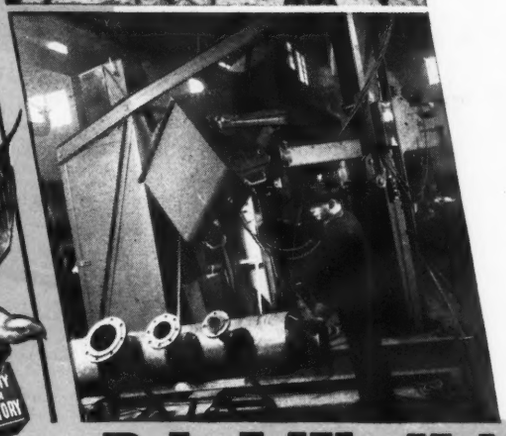


● The installation of Power Piping Functional Hangers and Vibration Eliminators which are expressly developed to control the behavior of your piping system.

SOME CONTROL PROCEDURES INSTITUTED BY POWER PIPING DIVISION







The correlated use of FLEX-ANAL CHARTS AND HANGER BULLETIN #1815 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained by requesting them on your business letterhead.

Optical pyrometer or thermo-couples which control temperatures during bending processes.

●

Photo-micrographs for checking and controlling grain size.

●

Automatic chart records for the control of preheat and heat maintenance during welding and during the annealing and subsequent stress-relieving.

●

Inspection of welds or workmanship is made by X-ray, gamma ray (using radium) or the Arcronograph.

BLAW-KNOX COMPANY

POWER PIPING DIVISION

1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

READ THIS 5-YEAR RECORD OF A-E-CO TAYLOR STOKERS

ANOTHER CASE IN THE MUNICIPAL PLANT FIELD

PROBLEM:

The problem at this plant was three-pointed. First, there was the selection of firing equipment capable of operating efficiently over a wide steaming range. Second, equipment able to meet sudden increases in steam demands. The third requirement was an ability to bank economically and operate at light loads without difficulties of flame stability and ignition.

RESULTS:

During the five-year period from 1937 to 1941 inclusive 4,133,528,000 lbs. of steam were generated from 200,579.5 tons of coal averaging 13,039 BTU per pound coal as fired. Average actual evaporation 10.3 lbs. steam per lb. coal. Operating conditions were 385 lbs. gauge pressure, 715°F. steam temperature, and 305°F. feed temperature to economizer. Preheated air temperature 280°F.-310°F.

SOLUTION:

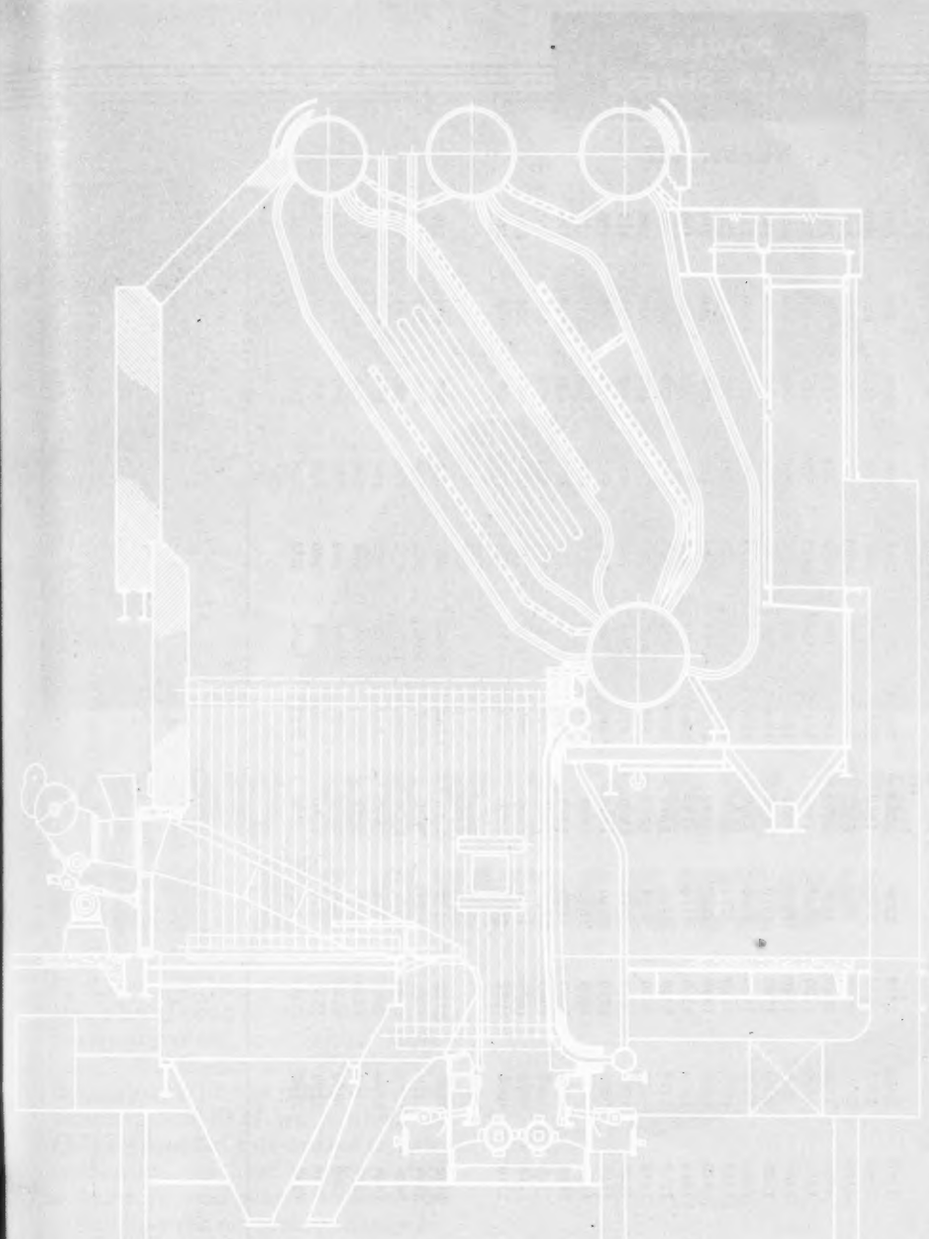
Three Taylor Stoker-fired Steam Generators were installed after a careful study of all feasible types of equipment. The capacity of each unit was 85,000 lbs. steam per hour. Several years later a similar unit of 125,000 lbs. capacity was added to the existing equipment.

CONCLUSIONS:

The average efficiency of 86.6% recorded over a full five-year period demonstrates once again the inherent ability of the Taylor Stoker to realize the highest operating economy in coordination with modern furnace design and modern heat recovery equipment.

AMERICAN ENGINEERING

PHILADELPHIA • PENNSYLVANIA



A-E-CO TAYLOR STOKERS ON THE FIRING LINE

*Aluminum Company of America, Edgewater, N. J.
*Aluminum Company of America, NewKensington, Pa.
American Tobacco Co., Inc., Durham, N. C.
Castanea Paper Company, Johnsonburg, Penna.
Chrysler Corporation, DeSoto Plant, Detroit, Mich.
*Collins and Aikman Corp., Roxboro, N. C.
City of Columbus, Ohio
*Consolidated Paper Company, Monroe, Michigan
*Cresson State Sanitarium, Cresson, Penna.
Defiance Milk Products Co., Defiance, Ohio
*DeLaval Steam Turbine Co., Trenton, N. J.
*Detroit Sulphite Pulp & Paper Co., Detroit, Michigan
City of Dover, Ohio
*Draper Corporation, Hopedale, Mass.
Erwin Cotton Mills Co., West Durham, N. C.
*Fisher Body Corporation, Detroit, Michigan
Fisher Body Corporation, Fleetwood Plant, Michigan
*Fisher Body Corporation, Grand Rapids, Michigan
*Fisher Body Corporation, Pontiac, Michigan
Fox Paper Company, Lockland, Ohio
Froedtert Grain and Malting Co., Milwaukee, Wisc.
*City of Galion, Ohio
*Gardner-Richardson Company, Lockland, Ohio
*General Electric Company, Erie, Penna.
*General Electric Company, Fort Wayne, Ind.
*Greenwood Electric L. & W. Plant, Greenwood, Miss.
*Board Public Works, Hannibal, Mo.
Hill School, Pottstown, Penna.
*Hobart Mfg. Co., Troy, Ohio
*City of Holland, Michigan
*Hope Natural Gas Co., Cornwell Station, West Va.
Hudepohl Brewing Co., Cincinnati, Ohio
Industrial Cotton Mills, Rock Hill, S. C.
*City Water & Light Plant, Jonesboro, Ark.
Kohler Company, Kohler, Wisc.
Maryland State Penal Farm, Roxbury, Md.
*Maybury Sanitarium, Northville, Michigan
Michigan Carton Company, Battle Creek, Michigan
*Michigan State College, East Lansing, Mich.
Municipal Light Plant, Marshfield, Wisc.
*Pacific Mills, Lyman, S. C.
*Packard Motor Car Co., Detroit, Michigan
*Municipal Electric Plant, Painesville, Ohio
*Park Drop Forge, Cleveland, Ohio
*Pennsylvania Electric Co., Seward, Penna.
*Pennsylvania R. R. Co., Philadelphia, Penna.
*Picatinny Arsenal, Dover, N. J.
*Pittsburgh Plate Glass Co., Barberton, Ohio
Borough of Quakertown, Quakertown, Penna.
Raleigh Wyoming Mining Co., Glen Rogers, W. Va.
*Rhinelander Paper Company, Rhinelander, Wisc.
City of Richland Center, Wisconsin
*City of Richmond, Indiana
Sayles Biltmore Bleachery, Biltmore, N. C.
Scotten Dillon Company, Detroit, Michigan
Shelby Cotton Mills, Shelby, N. C.
Sloane-Blabon Corp., Philadelphia, Penna.
*Solvay Process Company, Detroit, Michigan
*St. Elizabeth's Hospital, Washington, D. C.
City of St. Bernard, Ohio
Swarthmore College, Swarthmore, Penna.
*Timken Roller Bearing Co., Canton, Ohio
Timken Roller Bearing Co., Gambrinus, Ohio
Municipal Water & Light Plant, Tippecanoe City, O.
City of Toledo, Ohio
*Union Bleachery, Greenville, S. C.
Union Mills Paper Mfg. Co., New Hope, Penna.
*University of Wisconsin, Madison, Wisc.
*Vassar College, Poughkeepsie, New York
*Borough of Vineland, New Jersey
Warfield Natural Gas Company, Harold, Kentucky
White Sewing Machine Co., Cleveland, Ohio
Whiting Plover Paper Company, Stevens Point, Wisc.

(*) *Represents repeat orders.*

A-E-CO TAYLOR STOKER

A-E-CO TAYLOR STOKERS
WATER WALLS · ASH HOPPERS
HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES
LO-HED HOISTS

COMPANY

BEFORE YOU BUY ANY FUEL FIRING EQUIPMENT CONSIDER EACH OF THESE 12 FACTORS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE** — the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

© POWER

Faster Selection of Correct Steam-Pipe Thickness

II — Schedules 60, 80, 100, 120

Maximum working pressures for seamless carbon-steel pipe, ASTM A-106,-41. Grade B, silicon killed

Working temperature, F.				150	250	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
Allowable working stress, *S*, psi				15,000	14,400	13,800	13,400	13,200	12,900	12,600	12,300	12,000	11,400	10,400	9100	7400	5600	3800	2000
Pipe size, inches	Pipe OD, inches	Nominal wall thickness	Minimum wall thickness																
Schedule 60																			
8	8.625	0.406	0.355	1010	970	930	900	890	870	850	830	810	770	700	620	500	380	260	140
10	10.75	0.500	0.437	1040	1000	960	930	920	900	880	850	830	790	720	630	520	390	270	140
12	12.75	0.562	0.492	1010	970	930	900	890	870	850	830	810	770	700	610	500	380	260	140
14	14.0	0.593	0.519	980	940	900	870	860	840	820	800	780	740	680	590	480	370	250	130
16	16.0	0.656	0.574	960	920	880	860	840	820	800	790	770	730	660	580	470	360	250	130
18	18.0	0.718	0.628	940	900	870	840	830	810	790	770	750	720	650	570	470	350	240	130
20	20.0	0.812	0.710	970	930	890	870	850	840	820	800	780	740	670	590	480	370	250	130
24	24.0	0.937	0.820	950	910	870	850	830	820	800	780	760	720	660	580	470	360	240	130
Schedule 80																			
½	0.840	0.147	0.129	2820	2710	2600	2520	2480	2420	2370	2320	2260	2150	1960	1720	1400	1060	720	380
¾	1.050	0.154	0.135	2430	2330	2240	2170	2140	2090	2040	1990	1950	1850	1690	1480	1200	910	620	330
1	1.315	0.179	0.157	2440	2350	2250	2180	2150	2100	2050	2000	1960	1860	1700	1490	1210	920	620	330
1¼	1.660	0.191	0.167	1850	1770	1700	1650	1630	1590	1550	1520	1480	1400	1280	1120	910	690	470	250
1½	1.990	0.200	0.175	1660	1600	1530	1490	1460	1430	1400	1360	1330	1270	1150	1010	820	620	420	230
2	2.375	0.218	0.191	1600	1530	1470	1430	1400	1370	1340	1310	1280	1210	1110	970	790	600	410	220
2½	2.875	0.276	0.241	1840	1770	1690	1640	1620	1580	1550	1510	1470	1400	1280	1120	910	690	470	250
3	3.5	0.300	0.262	1690	1620	1560	1510	1490	1460	1420	1390	1350	1290	1180	1030	840	630	430	230
3½	4.0	0.318	0.278	1600	1540	1470	1430	1410	1380	1350	1310	1280	1220	1110	970	790	600	410	220
4	4.5	0.337	0.295	1540	1480	1410	1370	1350	1320	1290	1260	1230	1170	1070	930	760	580	390	210
5	5.563	0.375	0.328	1420	1360	1310	1270	1250	1220	1200	1170	1140	1080	990	860	700	530	360	190
6	6.625	0.432	0.378	1420	1460	1310	1270	1250	1220	1200	1170	1140	1080	990	860	700	530	360	190
8	8.625	0.500	0.437	1300	1250	1200	1160	1140	1120	1090	1070	1040	990	900	790	640	490	330	180
10	10.75	0.593	0.519	1270	1220	1170	1140	1120	1090	1070	1040	1020	970	880	770	630	480	330	170
12	12.75	0.687	0.601	1260	1210	1160	1130	1110	1090	1060	1040	1010	960	880	770	630	480	320	170
14	14.0	0.750	0.656	1270	1220	1170	1140	1120	1090	1070	1040	1020	970	880	770	630	480	330	170
16	16.0	0.843	0.738	1260	1210	1160	1130	1110	1090	1060	1040	1010	960	880	770	630	480	320	170
18	18.0	0.937	0.820	1260	1210	1160	1130	1110	1090	1060	1040	1010	960	880	770	630	470	320	170
20	20.0	1.031	0.902	1260	1210	1160	1130	1110	1080	1060	1030	1010	960	870	770	620	470	320	170
24	24.0	1.218	1.066	1260	1210	1160	1120	1110	1080	1060	1030	1000	950	870	760	620	470	320	170
Schedule 100																			
8	8.625	0.593	0.519	1580	1520	1460	1410	1390	1360	1330	1300	1270	1200	1100	960	780	590	400	210
10	10.75	0.718	0.628	1570	1510	1450	1410	1390	1350	1320	1290	1260	1200	1090	960	780	590	400	210
12	12.75	0.843	0.738	1590	1530	1460	1420	1400	1370	1340	1300	1270	1210	1100	970	790	600	410	220
14	14.0	0.937	0.820	1620	1560	1490	1450	1430	1390	1360	1330	1300	1230	1120	980	800	610	410	220
16	16.0	1.031	0.902	1570	1510	1450	1410	1390	1350	1320	1290	1260	1200	1090	960	780	590	400	210
18	18.0	1.156	1.011	1580	1520	1450	1410	1390	1360	1330	1300	1270	1200	1100	960	780	590	400	210
20	20.0	1.250	1.094	1550	1490	1420	1380	1360	1330	1300	1270	1240	1180	1070	940	770	580	400	210
24	24.0	1.500	1.312	1560	1500	1440	1400	1380	1340	1310	1280	1250	1190	1080	950	770	590	400	210

Tabulated values are gage pressures at which the stated weight of pipe can operate, calculated from the formula

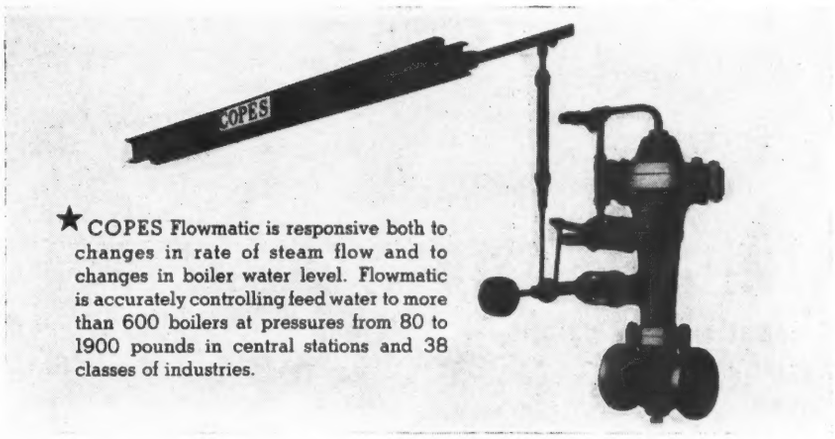
$$t_m = \frac{P\,D}{2\,S} + C$$

where t_m is minimum pipe wall thickness, inches
P is maximum working pressure, psi gage
D is actual outside diameter
S is allowable stress, psi
C is allowance for threading, mechanical strength and corrosion, inches

For Schedules 10, 20, 30, 40 see Data Sheet No. 121. Three tables in this series are by P H Hardie, Sanderson & Porter, Consulting Engineers. They are of correct size to paste in new edition of the Code for Pressure Piping.

"YOU SAY I CAN STILL GET FLOWMATIC"

That is right! Many COPES simple water level control regulators have been converted to COPES Flowmatic—the Steam-flow Water-level Regulator. With the introduction of Flowmatic in 1937 we notified all COPES users of this opportunity to modernize old feed water control systems. In most plants boiler loads at that time did not justify changes—but today's 168-hour-peak-capacity operation calls for close attention to all boiler auxiliaries. It is possible to get more steam from your present boilers—hold pressures more uniform and lighten the load on pumps and governors by using Flowmatic, steam-flow water-level regulator.



★ COPES Flowmatic is responsive both to changes in rate of steam flow and to changes in boiler water level. Flowmatic is accurately controlling feed water to more than 600 boilers at pressures from 80 to 1900 pounds in central stations and 38 classes of industries.

★ COPES Flowmatic, the steam-flow water level Regulator utilizes the standard COPES Thermostat and BI Valve in a compact, sturdy design that is handling boiler feed water control on over 2,225,000 boiler horsepower. Flowmatic will get more steam from your present boilers—will hold steam pressure more uniform thru continuous feeding according to steam flow. The answer to your boiler water level problem may be part of this record. May we tell you more about the possibility of converting to Flowmatic? Write today giving description of your boiler operation. Write for Bulletin 429.

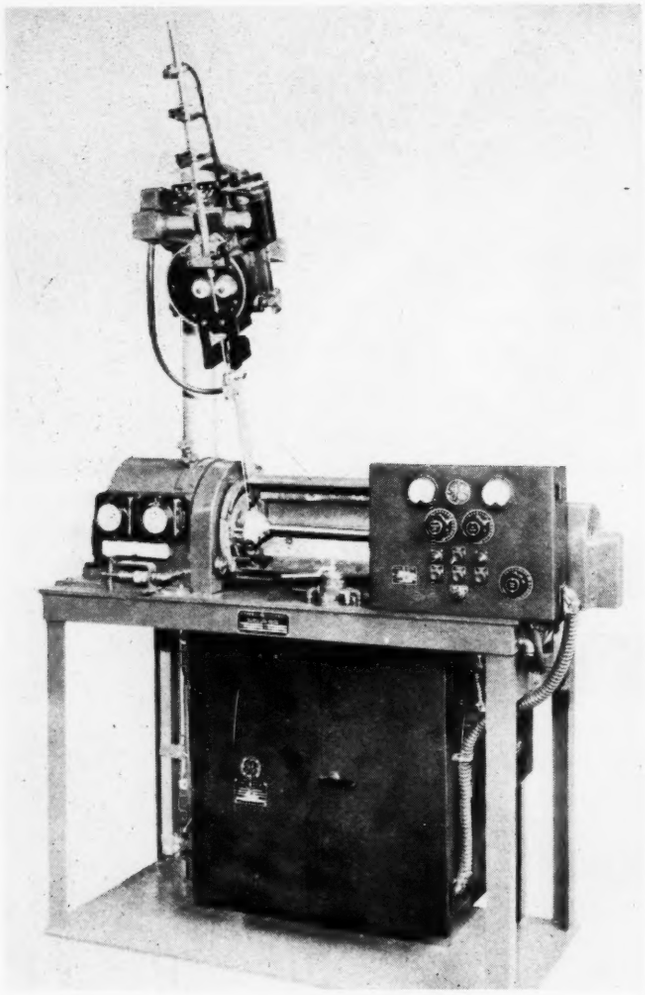
NORTHERN EQUIPMENT COMPANY • **1021 Grove Drive, Erie, Pa.**
Feed Water Regulators • Pump Governors • Differential Valves • Liquid Level Controls
Reducing Valves and Desuperheaters
BRANCH PLANTS IN CANADA, ENGLAND **REPRESENTATIVES EVERYWHERE**

OVER 60,000 COPES FEED WATER REGULATORS IN SERVICE

★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

WHAT'S NEW IN PLANT EQUIPMENT



Automatic Arc-Welding Equipment

COMPLETE EQUIPMENT for automatic arc welding with heavily coated electrodes in cut lengths has been announced. Essential elements of this equipment have also been made available so that automatic arc-welding heads originally designed for operation with thyratron-controlled coiled electrodes can be converted for successful welding with stick electrodes. Mechanism includes a clamp used for holding any standard stick electrode and transmitting current to the electrode. The clamp is attached to the feed-rod end upon which two feed rolls operate to maintain the proper arc voltage through automatic thyratron control. Electrode accurately guided to maintain arc in a predetermined location. Limit switches govern the extremes of movement in either direction. *General Electric Co, Schenectady, N. Y.*

Timer

RECENT DESIGN IMPROVEMENTS have increased performance characteristics on Series 2800 "Vernier-Set" timers. Standard features of Telechron motor, simple knob setting without locking device, silver contacts and hand adjustments to slides and bridges are now augmented with: (1) One-piece molded bakelite terminal block accommodating all external wiring to clearly marked screw post terminals, as well as bridge positions for easy selection of desired arrangement; (2) leaf-spring contact for positive make-break action; (3) timer and load circuits wired independently, and (4) flaminol and special flexible wiring employed throughout. Timers available in two types—normal-clutch-action for resetting upon power failure; and reverse-clutch-action for non-resetting on power failure. *Automatic Temperature Control Co Inc, 34 East Logan St, Philadelphia, Pa.*

Hydraulic Pump

ILLUSTRATION SHOWS a 6-plunger fully-enclosed hydraulic pump. All moving parts are pressure lubricated and connecting rods run in a continuous oil bath. Roller bearings are used throughout. Maximum pump capacity is 400 hp. Herringbone gears, running in a continuous oil bath, are used for driving the pump, insuring long gear life. The pump can be equipped with built-in bypass valves or safety valves, as may be desired. *Charles F Elmes Engrg Works, 230 N Morgan St, Chicago, Ill.*

Plug Valves

"LEVER-SEALD" PLUG VALVES designed for 150 psi working pressure. Face-to-face dimensions of each valve in new line are the same as those of corresponding size wedge-gate valves, and thus are instantly interchangeable with wedge-gate valves without piping changes. Other new features include Homestead's "quarter-turn" operation and powerful leverage to provide positive, extra-easy opening or shutoff under all conditions. Sizes range from 1½ in. to 10 in. in semi-steel or steel. *Homestead Valve Mfg Co, Coraopolis, Pa.*

Natural Graphite

HYDRITE contains 22% by weight of colloidal natural graphite dispersed and in complete suspension in water. It contains no oil, alkali or chemical and has no effect on rubber. It is a corrosion inhibitor and is unaffected by acids, acid fumes or vapors, according to the manufacturer. Pure natural graphite film created by Hydrite is electrically conductive and chemically inert. Maker claims that Hydrite can be diluted by water many times its own volume without lessening its lubricating properties. Proportion of water added

(*Continued on page* 142)

HELP FOR MEN WITH VALVES TO REPAIR

Newest "PIPING POINTERS" *Show How To Do It!*

TO keep pipe lines flowing and war production humming—now when piping replacements are hard to get—means that valves must be kept in proper repair. The latest "Piping Pointers" Bulletin will help you do just that. It answers dozens of questions on "how to do it!" Coming from Crane—America's largest manufacturer of valves—you can be sure the information it gives is sound and practical.

Not only does Bulletin No. 5 tell *how to do it,* but illustrates modern valve repair methods with actual photographs. It's a valuable reference for any piping man—*veteran* or *beginner;* ideal for employee training school use. It serves a dual purpose: (1) to help get renewed life from valves, (2) to conserve critical materials.

"Piping Pointers" Bulletins are one of the ways Crane Co., as the leader in its field, is sharing its basic information with other industries producing for Victory. Copies of Bulletin No. 5, and preceding issues covering other subjects of piping maintenance, are available *free* to any plant. Your Crane Representative will gladly supply them or, you may write direct.

CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVENUE, CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Shut Up! . . .

"Between you and me and the lamp-post . . ."—and some more of somebody else's business passes from one American to another. In bars, cars, clubs and locker rooms, wherever Americans gather, we indulge in what somebody has very accurately called "spilling our brains." Like the old maid who confessed her youthful indiscretions for the hundredth time, we enjoy talking about it more than doing it.

People in coastal-city offices include in the day's gossip just what ships came and went, men on isolated defense projects come home to brag about their part in the war, soldiers home on leave are subjected to cross-examination and armchair advice on how to win.

A friend of mine who is a little on the talkative and critical side, was riding between two port cities on the train recently. He spotted a large naval vessel on its way out to sea, and pointed it out proudly to his stranger seat-mate. The stranger said: "Look, Brother, you shouldn't have seen it, and if you did you shouldn't have told me. You see you don't know me—I'm not an American citizen. I happen to be British—and we've learned to our sorrow that you'd best shut up about troop movements even when you're talking to friends. Loose talk has cost us plenty of lives!"

I wish there were more people like that forthright Briton! They might eventually stop us of our centuries-old enjoyment of bragging over what we know—an enjoyment which we must let go for the duration. Remember that airplane and radio have shrunk both time and distance, and the New York whisper of today is Berlin gossip tomorrow.

Industrial power-plant employees are involved in installation and maintenance of power service all over their employers' factories, hence see and hear more about war production than other employees. That puts it squarely up to us to see that we—and those around us—make the spy's job as difficult as possible, even if it does mean that we can't show off our superior knowledge until after the war.

To put it simply, let's shut up!

George Edwards

Engineer

INTERLOCKED is One Rod Packing that

Can't Come Apart

J-M INTERLOCKED—*the greatest single improvement ever made in braided packing*

Once Interlocked is installed, you can be sure that repacking jobs will be few and far between. This unique braided material has no jackets to wear through or come apart . . . no plaits to loosen. It is braided square, rather than pressed into shape, and thus presents a better contacting area . . . provides a tight seal with minimum gland pressure and take-up.

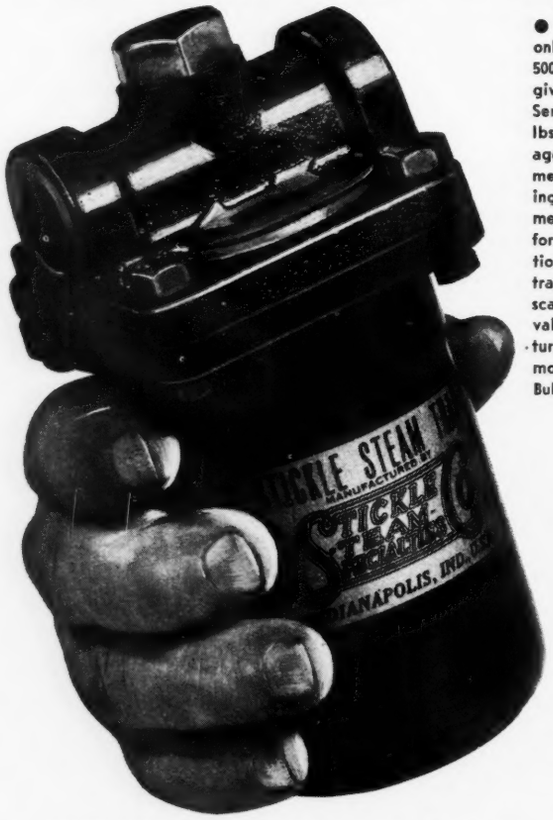
J-M Interlocked is provided in a variety of styles to meet a wide range of operating conditions. For details, and for facts on other money-saving J-M Packings and Gaskets, write for Catalog PK-12A. Johns-Manville, 22 East 40th Street, New York, N. Y.

J-M Interlocked is available for prompt delivery . . . See your nearest J-M Distributor

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS

STICKLE PROVIDES
EVERYTHING
YOU REQUIRE OF A STEAM TRAP



● This No. 110 Stickle Trap weighs only 4½ lbs. It has a capacity of 500 lbs. an hour. Three larger sizes give the four traps in the Stickle 100 Series a capacity range up to 3,000 lbs. an hour. Afford efficient drainage for unit heaters, laundry equipment, jacketed kettles and other drying and processing units operating at medium and high pressures. Designed for economical straight-in-line installation. Body removable without taking trap from line. Internal strainer keeps scale and dirt particles from reaching valve. Trap by-passed by quarter turn of nut at top. In every way a more efficient steam trap. Ask for Bulletin No. 115.

● Stickle AE Series Traps built for working pressures up to 200 lbs. (450 lbs. if made of steel). Capacities approximately four times old standard traps of comparable size. Seven sizes supply capacity range of 5,000 to 21,000 lbs. an hour. Ask for Bulletin No. 315.

1. **DEPENDABLE SERVICE**—Stickle obviates most "steam trap troubles" with the natural Stickle Open Float Principle, and stark simplicity of construction. Location of valve in top of trap prevents scale and dirt obstruction.
2. **POSITIVE OPERATION**—Filled open float releases valve for trap discharge. Emptied open float regains buoyancy and closes valve. Both actions instantaneous—positive—frictionless. No steam blown at end of discharge—perfect water seal at all times. Air and gases eliminated with each discharge.
3. **FREEDOM FROM REPAIRS**—Absence of hinges, levers, pins—all unnecessary mechanical parts—leaves few things to repair or replace. Chromium valve and seat, always in perfect fit through constant regrind action of trap in operation, never stick.
4. **MAXIMUM CAPACITY WITH MINIMUM SIZE** — Large capacity of Stickle Traps in ratio to size affords installation convenience as well as installation economy. Each series, or design, of Stickle Traps built to meet specific conditions and give best results and most efficient performance under operating requirements.

● Stickle Series 50 Pop Valve Traps built especially to meet the special drainage requirements of evaporating, cooking and other processing equipment operating at high pressures, creating large volumes of condensate. Ask for Bulletin No. 515.
● Stickles Series T Traps for low pressure and for vacuum service described in Bulletin No. 415.

STICKLE
STEAM SPECIALTIES COMPANY
2263 Valley Avenue, Indianapolis, Indiana
SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

New Equipment

(*Continued from page* 138)

to graphite is varied according to application. Hydrite is a penetrating medium for impregnating any porous material such as asbestos fibers, brake linings, fabrics, grinding wheels, leather and paper, to incorporate the electrical conductivity and lubricating properties of natural graphite. *National Graphite Co Inc, 17 John St, New York, N. Y.*

Fluorescent Lamp Ballast

FOUR-LAMP BALLAST for fluorescent lighting requires 48% less copper, 47% less iron and steel, and 50% less aluminum than the two previous 100-watt 2-lamp ballast. New ballast will operate four 100-watt lamps, but costs no more than the 2-lamp 100-watt ballast. Unit operates over a line-voltage range of 250-280 volts, and is applicable to circuits in the 265/460-volt Y class. *General Electric Co, Schenectady, N. Y.*

Steel Condenser Unit Heaters

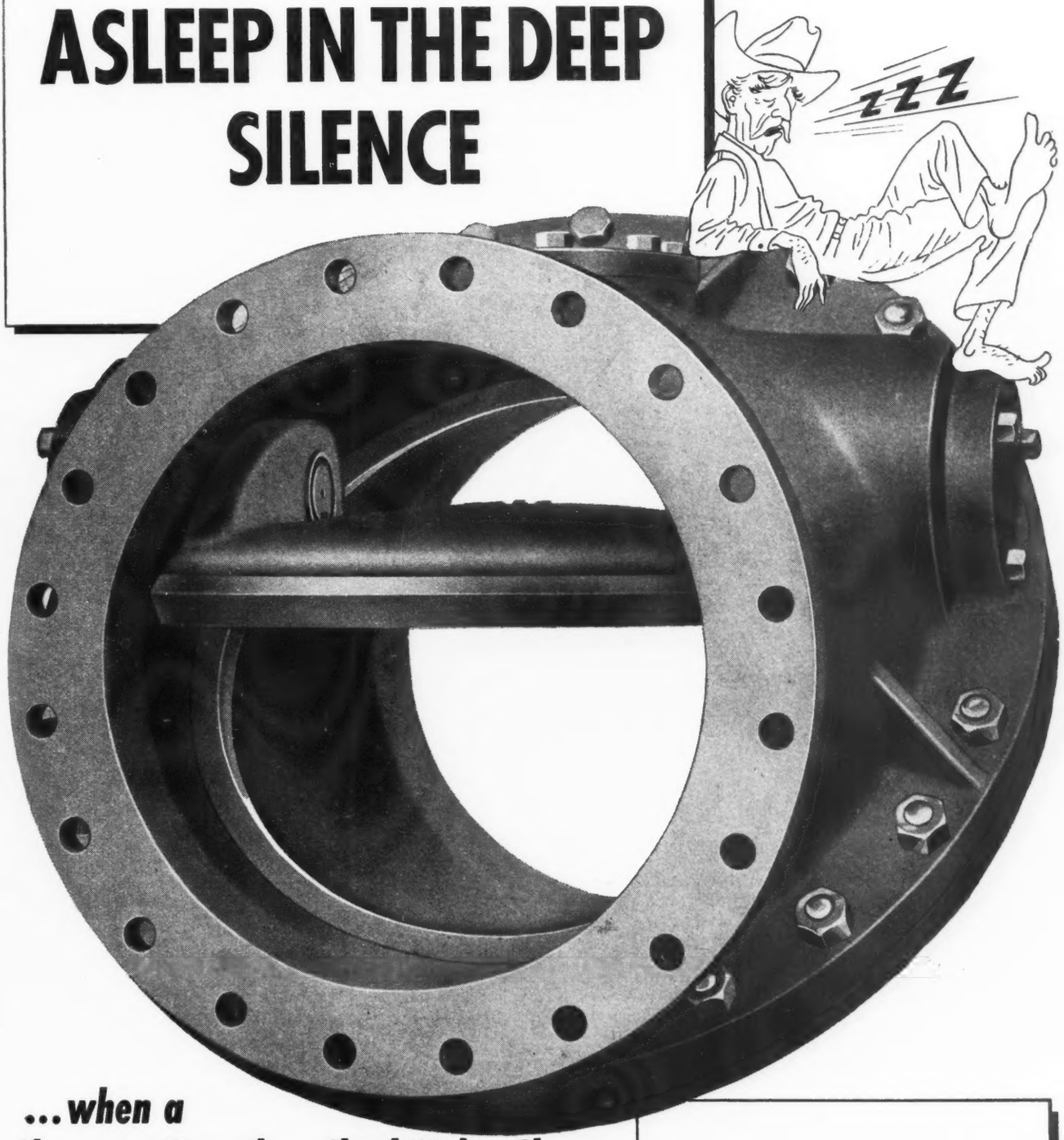
MODINE STEEL CONDENSER UNIT HEATER has been designed to conserve critical copper and copper alloy. Designated as Style S/S and includes both horizontal- and vertical-delivery unit heaters. Tubes have an extra heavy wall thickness of 0.065 in. Steel fins are permanently bonded with metal to ingot iron tubes, to seal the vital contact of fin to tube from corrosion. To reduce the possibility of rusting and corroding fins, and subsequent cutting down of net free area between them, the units are dipped in a lead alloy bath after being welded and brazed. *Modine Mfg Co, Racine, Wis.*

Fire Extinguisher

COMPANY STATES that this Alfite carbon-dioxide unit is only 100 lb unit approved by Underwriters' and Associated Factory Mutual Laboratories for use on both electrical and oil fires. Unit equipped with an Anti-Statik horn to protect operator from static discharge, and is designed for perfect balance at wheeling height. Has third swivel wheel for easy maneuvering and retaining latch which releases horn instantly yet holds it firmly in place when it is not in use. Recommended for fires in flammable liquids, alcohol storage, electrical machinery, and for

HE STAYS

ASLEEP IN THE DEEP SILENCE



...when a Chapman Non-Slam Check Valve Closes

This sleeping beauty would never hear or feel a thing, if a Chapman tilting disc closed down right under his ear. No slam, no hammer, no surging . . . not a sign of any disturbance. But just the same — *the disc has closed quickly, to a drop-tight seat.* That's because of the balanced, air-foil design that keeps the disc riding evenly in the flow. Then when flow slows, the disc is cushioned silently into place.

This exclusive feature means 65% to 80% less head-loss . . . lowered pumping costs . . . and almost no wear in the valve itself. Write for free book which gives complete operating and installation data.

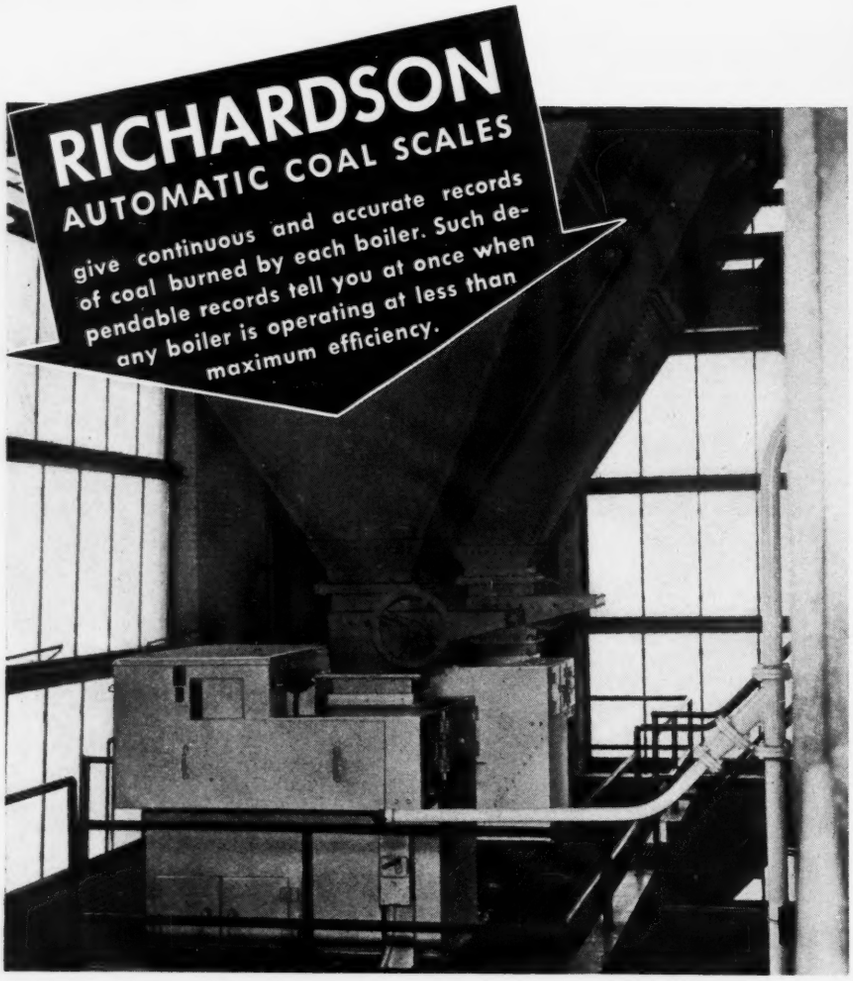
The CHAPMAN VALVE Mfg. Co., Indian Orchard, Mass.

Chapman

TILTING DISC CHECK VALVES

ON GUARD
against waste of coal

Whether your boiler plant is small or large, it is most essential for you to avoid any waste of coal, caused by dirty tubes, improper draft regulation, etc.


RICHARDSON
AUTOMATIC COAL SCALES
give continuous and accurate records of coal burned by each boiler. Such dependable records tell you at once when any boiler is operating at less than maximum efficiency.

Increase Steam Production—Lower Your Power Costs

Richardson Coal Scales—dustproof—all welded construction—easy access to all parts—are built to suit conditions in existing plants and to improve angles of flow of Coal. Catalog A-21240.

RICHARDSON

RICHARDSON SCALE COMPANY, CLIFTON, N. J.

Atlanta Boston Chicago Minneapolis Montreal New York
Omaha Philadelphia San Francisco Syracuse Toronto Wichita

2738

other class B and C fires. *American-LaFrance-Foamite Corp, Elmira, N. Y.*

Welding Control

REMOTE-CONTROL UNIT now standard production feature of all welders made by company. Improved control said to be protected fully from accidental breakage by a metal pull-out handle set over the control dial, and by cushion springs on the back of porcelain rheostat. Large outer-control dial

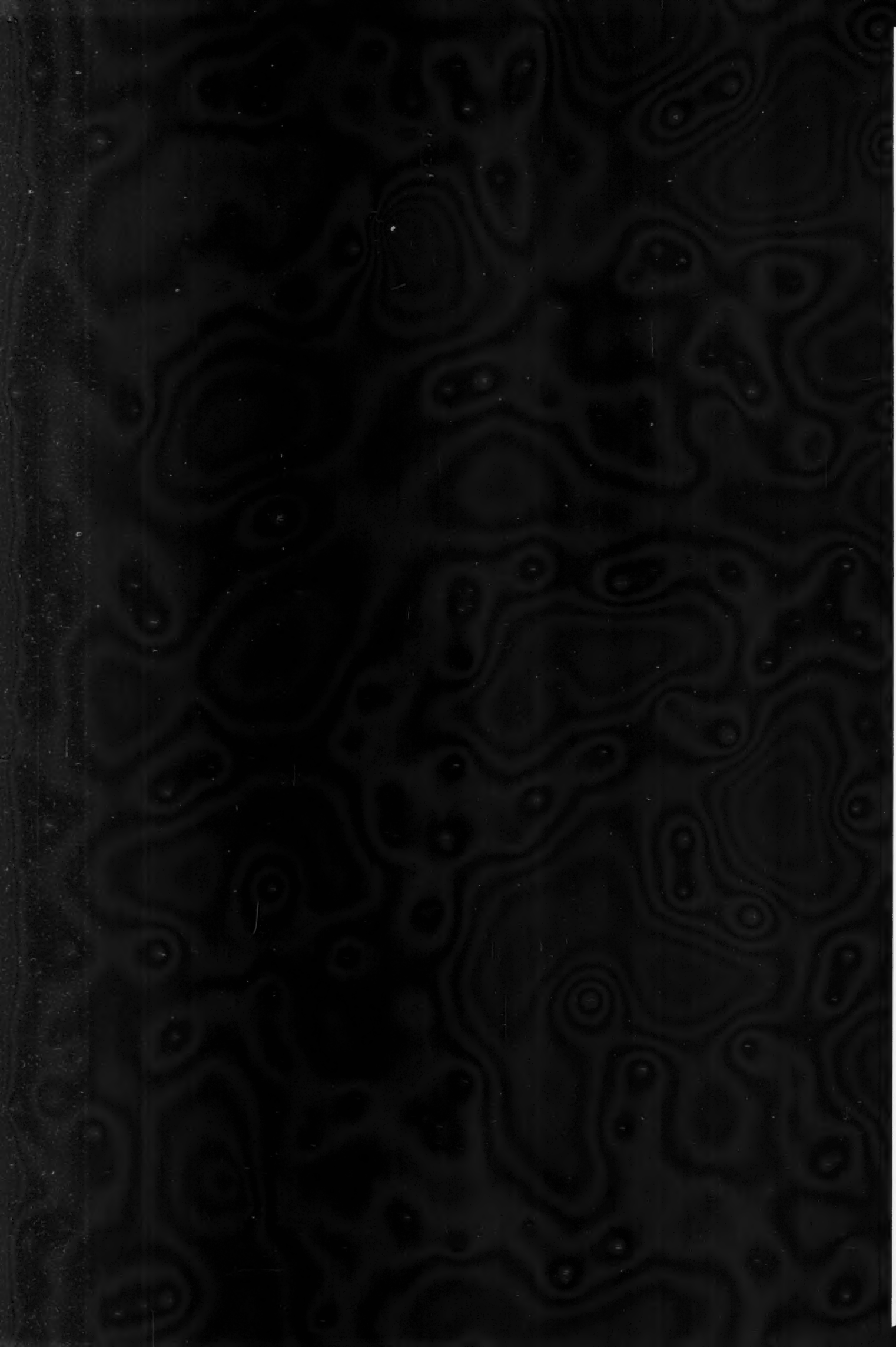
shown in the picture is field rheostat which controls differential compounds —while remote-control unit adjusts open-circuit voltage. One thousand combinations of voltage and current are possible with dual-control dial. Remote-control unit places 100 steps of fine volt-amperage adjustment within reach of operator's hand. Unit is easily set up by using an ordinary lamp-cord extension to connect it to machine. *Hobart Bros Co, Troy, Ohio.*

Spray Attachment

"THUMB-SPRAY NOZZLE ATTACHMENT shown has been developed by company for converting present extinguisher equipment. Clamps over the 3/8-in. hose and nozzle of any standard soda-acid, foam, gas-cartridge or pump-tank fire extinguisher. Thumb-Spray is a permanent attachment made of spring steel with a deflector edge which influences range and distribution of spray for maximum effectiveness. Normally solid stream is converted into a spray by applying pressure with the thumb at attachment end. Since this conversion takes place only after liquid leaves nozzle, the extinguisher is not affected. Operating pressures, chemical reactions or normal streams are not impaired. *Pyrene Mfg Co, Newark, N. J.*

Transformer Cooling System

ELECTRO-COOLER UNIT said to step up capacity of transformers already in service by about 20–40%. Forced-oil system of cooling transformers is made highly practical with the Electro-



Prevent Valve Failure

before it starts!

CHOKED TO DEATH
by accumulated deposits, because of improper installation, and lax servicing . . .

This valve never had a chance! It was installed in a downward line where the solids collected while the valve remained closed. The deposits choked off the flow of liquid and destroyed the seat.

A more favorable location of the valve in the line, or the use of a type better suited to the purpose, would have prevented the collection of solids. Or, if the line had been provided with a drain, if it had been flushed out at regular intervals – even in its faulty location, the valve could have been kept in service indefinitely.

All valve metals are precious today. Except for valves in the most essential wartime service, replacements are practically unobtainable. Careless destruction *must* be prevented, and it *can* be prevented, *before it starts* . . . by regular, systematic inspection . . . by replacement of worn parts in time to prevent valves from destroying themselves. Instruct new maintenance workers thoroughly. Select valves for new construction carefully; install them properly.

Valve conservation, always good practice, is now a vital factor in maintaining the flow of arms and supplies to our fighting men. Keep your valves operating efficiently. Jenkins Engineers are ready to advise any management in the fundamentals of effective valve conservation.

Army-Navy "E" Pennant, awarded to Jenkins Bros. for meritorious achievement in the production of war material.

REG. U.S. PAT. OFF. TRADE JENKINS MARK Jenkins Bros.

Jenkins Bros., 80 White Street, New York, N. Y.; Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill.; Houston, Texas. Jenkins Bros., Limited, Montreal; London, England.

JENKINS VALVES

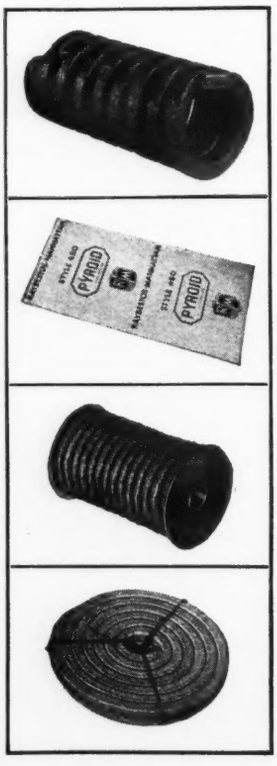
For every industrial, engineering, marine and power plant service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

"Hold that line!"..with R/M PACKINGS

Steam lines, oil lines, air lines, fuel lines . . . all must operate under higher pressures today as production calls for speed and more speed. R/M packings are made to Hold That Line, up to the limit beyond which no machine or material can be pushed.

R/M engineers are constantly testing and re-testing to prove and improve, so that R/M packings *can* take it, *can* meet the stepped-up strains and stresses of production for all-out war. R/M means Raybestos-Manhattan. R/M means Reliable Materials.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.



INDUSTRIAL SALES DIVISION

RAYBESTOS-MANHATTAN, INC.

MANHEIM, PA.

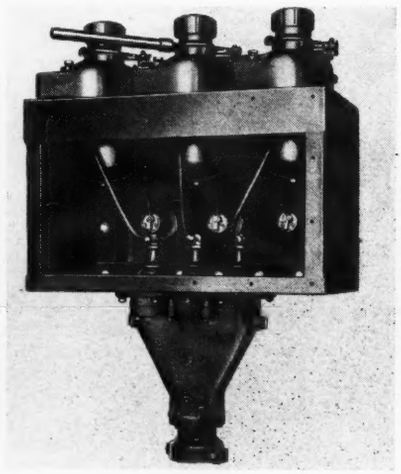
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.

Makers of Packings for Every Industrial Use

Cooler, because unit compact, factory-assembled and factory-tested at high pressure to minimize possibility of future maintenance. Unit consists of radiator-type cooler and special pump with motor inclosed. These are connected by piping to standard radiator valves at transformer side. No stuffing boxes are required in special pump and the motor is self-cooled and self-lubricated. Because the unit is relatively small, more than one is usually required, the number depending on transformer size. Greater reliability can be expected from multiple units, since operation of one is independent of the other. For the current emergency, Electro-Coolers can be built into new transformers and into transformers already in service, subject to recommendations of the transformer manufacturer. If transformers are equipped with conventional radiator valves, installation can be made in three to four hours without removing the oil in the transformer. *Allis Chalmers Mfg Co, Milwaukee, Wis.*

Oil Fuse Cutouts

METAL-ENCLOSED ASSEMBLY of gang-operated oil fuse cutouts are for short-circuit protection and switching. New assemblies permit totally metal-enclosed installations, either single- or three-phase. They save installation labor because each unit is factory-assembled with flexible, insulated cable leads ready for connection to either single- or multi-conductor cable. Leads enter the individual cutouts above the oil level, thus preventing oil loss. Switching requires merely throwing a lever 90 degrees. Fuse carriers can be removed without disturbing the gang-operating mechanism. New assemblies are particularly well adapted for use (indoor or outdoor) in industrial plants for branch circuits, individual transformers or banks, motors, control ap-



IT'S THE OFFENSE THAT WINS BATTLES

Since 1940, the Nazis have won battle after battle. Why? Because they've waged one offensive after another.

ALTER EGO: Yes, but they've been able to do that. They started their *war production offensive* 10 years ago so they had a big edge on us in tanks, planes and guns. Then we really started competing.

So competition forces progress. *Look how in two years, our* production offensive *has already surpassed that of the Axis—turning out better weapons and more of 'em. These new arc welded M-4 tanks, for example. They'll soon be in our fighting offensive.*

ALTER EGO: It's thrilling but don't let it get us complacent. Haven't we learned never again to be caught unprepared in war . . . or in *business competition* either?

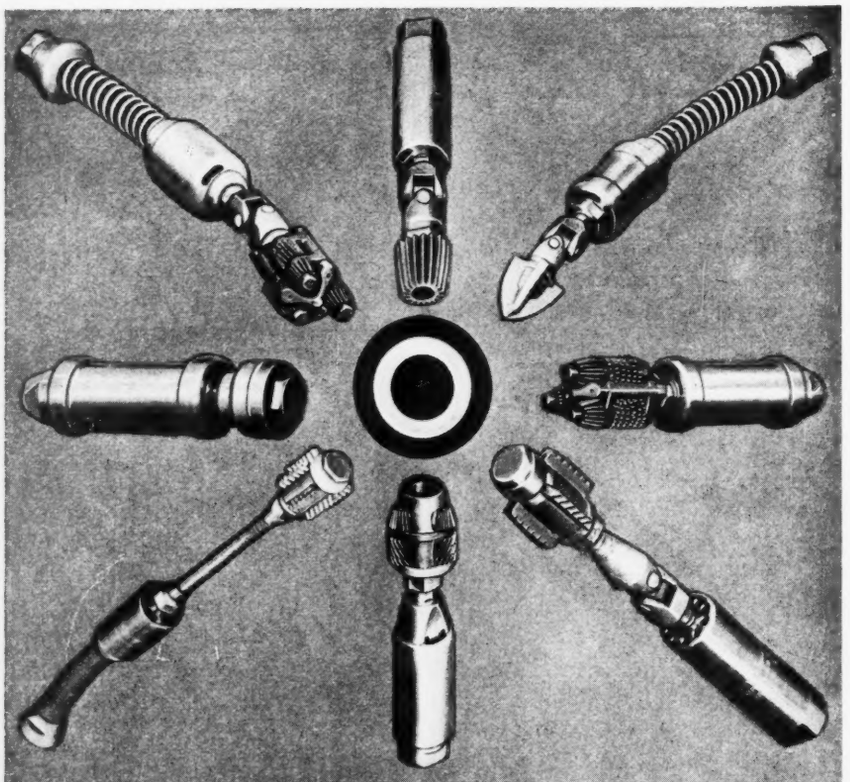
There you have it! Let's start TODAY waging a planning and designing offensive *so we'll be on the alert with better welded products and lower costs to get the upper hand on our competition the minute the post-war Battle for Business begins!*

Ask *your* inner self if it isn't the offense that wins battles.

THE LINCOLN ELECTRIC COMPANY
CLEVELAND, OHIO

then I said to myself—

IT'S A GREAT JOB —WELD DONE!



DON'T LET DIRTY BOILER TUBES SABOTAGE YOUR WAR PRODUCTION

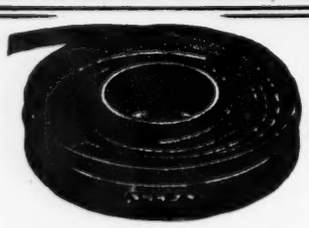
Maximum plant production—never more important than at present—can be maintained only when boilers operate at *maximum* efficiency. Dirty tubes reduce boiler efficiency materially. Long or frequent shutdowns for tube cleaning are costly. Both reduce plant output.

There is a Wilson Tube Cleaner, cutter head, brush or other accessory which quickly, thoroughly and economically overcomes *any* scale or sludge condition encountered in straight or curved ferrous or non-ferrous tubes of large or small diameter.

You can quickly satisfy yourself that Wilson Tube Cleaners maintain boiler efficiency at the maximum, increase production and save tubes, time and trouble. Write for the name of our representative nearest to you or ask for a copy of our NEW forty-page catalog which fully describes and illustrates the complete line of Wilson tube cleaning equipment.

INVEST IN AMERICA! BUY WAR BONDS AND STAMPS!

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.



ALLPAX
THE PACKING THAT "PACKS ALL"
. . . use it once and
. . . you'll use it always

THE ALLPAX CO., INC.
Mamaroneck, N. Y.
•
Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all—economically, efficiently—tightly—simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

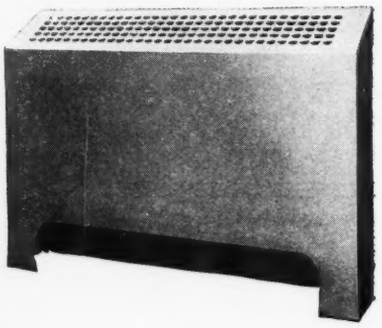
paratus, electric heating and other equipment. New assemblies can be supplied for wall or direct-to-apparatus mounting, with openings for conduit, cable or pothead connections. *General Electric Co, Schenectady, N. Y.*

Welding Electrode

NEW ELECTRODE designed specifically for all-position welding of mild steel with ac welding machines. Made in the following diameters: $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$ and $\frac{5}{32}$ in. Wilson No. 530 electrode complies with all requirements of the American Welding Society Classification E6011, American Bureau of Shipping, Group HIG and BIG for ac and other specifications. High quality of deposited metal of No. 530 is fully comparable to that of the best dc reverse polarity all-position electrodes—*Wilson Welder & Metals Co, Inc, 60 East 42nd St, New York, N. Y.*

Cabinet Convector

NON-METALLIC CABINET CONVECTOR replaces all-metallic convectors and radiators. Except for screws, cabinets are constructed entirely of non-metallic materials. Side and top panels are fabricated from rigid fiber board, while supporting members at the corners are hard wood. Element of the non-metallic



cabinet convectors is constructed of steel fins and tubes. Amount of metal used in these new convectors is equivalent to one-fifth of that used in the ordinary radiator. Two cabinet types are available, one provided for wall suspension and the other a free-standing floor unit. *Trane Co, La Crosse, Wis.*

Variable-Speed Drive

A VARIABLE-SPEED multi-V-belt-drive announced by the company. Model A "Allspeed Drive" has a horsepower range of from $\frac{1}{3}$ to $\frac{3}{4}$ hp with a speed ratio of 16 to 1, that is, any speed from $\frac{1}{8}$ to twice the driving motor speed. Drive is said to be exceptionally compact, ball-bearing equipped and so designed that it can be operated in any

New TUBE-TURN WELDING FITTING CATALOG *and* ENGINEERING DATA BOOK

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- *Expansion Loop Chart and how Used
- Cold Springing
- *The Flow of Fluids
- Viscosity Conversion Chart
- Pressure Loss Chart
- *Flow of Flashing Mixtures
- *Steam Flow Through Pipes
- Properties of Pipe
- Dimension Tolerances for Welding Fittings and Flanges
- Pressure Ratings for Flanges
- Physical and Chemical Requirements for Flanges
- Pump Capacities
- Hardness Conversion Table
- Gas Density
- Table for Gauging Horizontal and Cylindrical Tanks
- Conversion Tables
- List of Welding Symbols, Material Color Code, Labeling Abbreviations

* This data was compiled exclusively for Tube Turns and is presented for the first time in Tube-Turn Catalog No. 111.

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You will find this new 232 page Tube-Turn Catalog and Engineering Data Book the *most useful, most helpful* and *most complete* book available on pipe welding and welding fittings and flanges. It includes *all* up-to-date and essential technical data on the design of welded piping systems and the use of welding fittings—*plus many exclusive new studies.* Every detail is planned to make it *very convenient to use* and *easy to find what you want.* Catalog 111 will be off the press in November. Write on your business letterhead for your free copy *now*—or send coupon at right!

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TUBE TURNS, INC., 142 E. Broadway, Louisville, Ky. ● *Branch Offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Tulsa, Houston, Los Angeles. ● *Distributors in all principal cities.*

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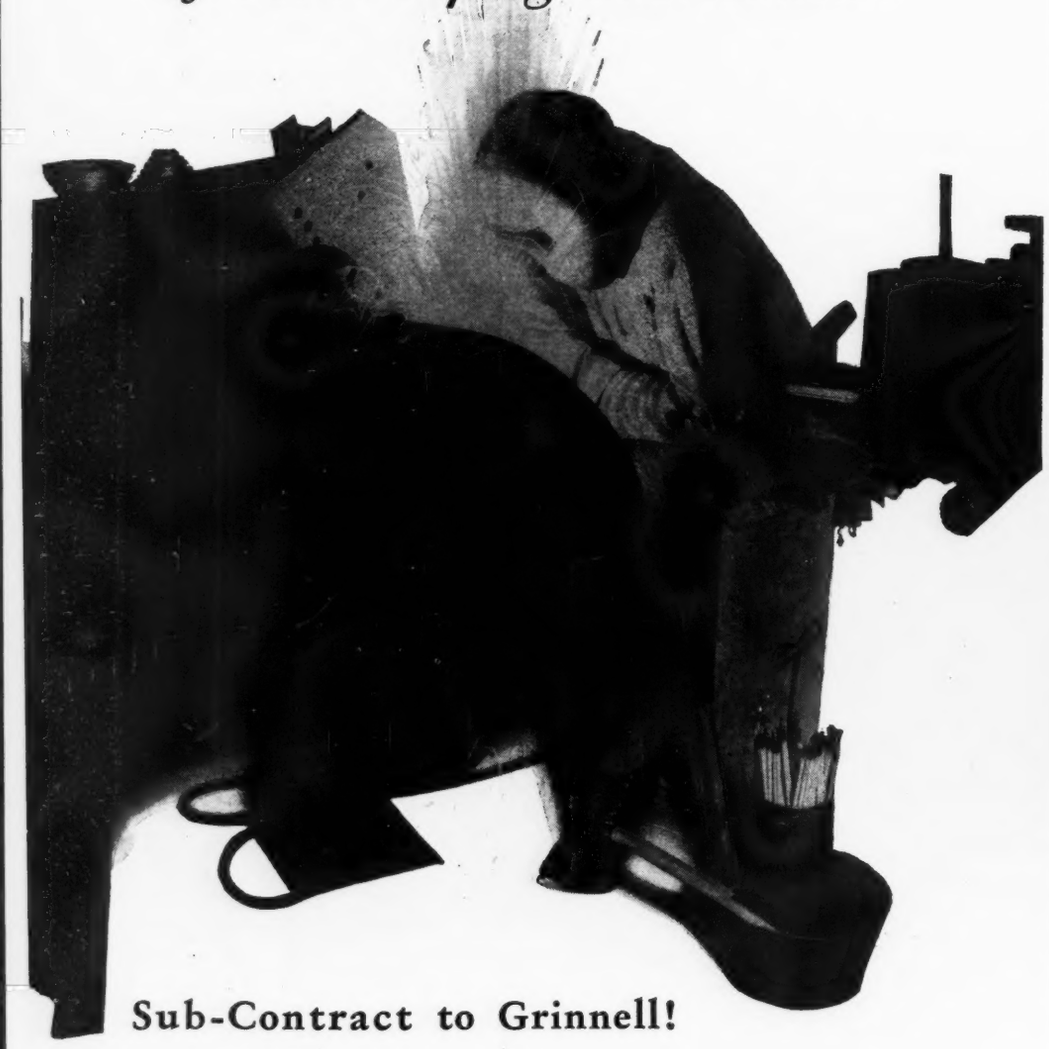
How to

"DUCK THE MISERIES"

of Power Piping Fabrication!



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Are you planning extensions of power or process facilities? Here's a way to free yourself from a load of detail work and supervision. "Give the Plans to Grinnell", as soon as special piping requirements are roughed out!

Grinnell engineers are equipped by long experience to interpret power and processing layouts into super-piping systems. Grinnell plants, strategically located to serve war industries, have complete prefabrication facilities to produce underwriter-approved sub-assemblies for speediest erection.

Why not "duck the miseries" this way . . . save yourself an exacting engineering job . . . reduce time-consuming field erection . . . lop off weeks or months in getting top-grade installations. Write for booklet, "Grinnell Piping Prefabrication". Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities of United States and Canada.

Prefabricated Piping

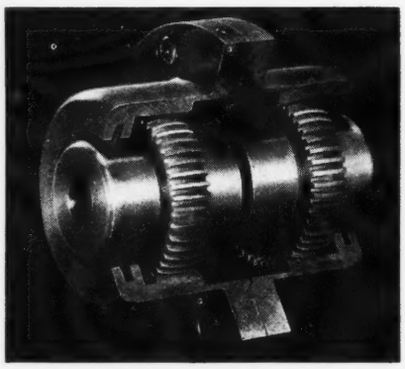
by GRINNELL

WHENEVER **PIPING** IS INVOLVED

plane. Can be directly coupled to any standard motor and output shaft can be run at motor speed, and is flexible enough to be applied to any machine within its power range. Interesting feature of the drive is its mechanical, positive belt-tensioning device which automatically compensates for increased arc of belt contact which results from changing from low to high speeds. *Worthington Pump & Machinery Corp, Harrison, N. J.*

Gear Coupling

BARCUS GEAR COUPLING for driving and driven shafts comprises a cylindrical housing shell cut with internal gears having stub teeth with 20-deg pressure angle. Driving and driven shafts are respectively connected to hubs of generated gears each cut on a true central segment of a sphere, surface of teeth



being of constant width throughout their length. Teeth of each spherical gear meshing in stub teeth of housing produces smooth ball action contributing to reduction of friction and pressure on shaft bearings if shafts are out of alignment. Nature of the spherical gear permits misalignment up to 3 deg on either shaft, or a total misalignment up to 6 deg. *John Barcus Engineering Co, 3931 Falls Road, Baltimore, Md.*

Welders' Safety Clothing

TO PROTECT WELDERS against painful and dangerous exposures to molten metal sparks, company announces completely new and wide assortment of high-grade welders' safety clothing that will keep hot sparks away from skin and normal work clothes. Clothing is made from the highest grade chrome-tanned cowhide weighing approximately 5 oz per square foot. Most of the garments are cut from Kip splits. the whole hide of the animal. Fire-resisting duck is used for backing and weighs approximately 12 oz per square yard. All seams are double cotton stitched and reinforced with metal stitching and in areas of extra tension and strain re-

World's Largest Malting Company MODERNIZES WITH HAYS

FROEDTERT GRAIN & MALTING COMPANY of Milwaukee began a power plant rebuilding program in 1940—the fifth power modernization made necessary through nearly 60 years of growth. A complete new boiler plant was installed in 1941 consisting of two 6500 sq. ft. 3-drum, 3 pass, water-tube boilers with superheaters, economizers and water cooled furnaces fired by multiple-retort underfeed stokers. A complete Hays system of automatic combustion control centralized on a boiler operating panel maintains highest operating efficiency with steam pressure held constant regardless of load. The entire system is electrically operated with provision made for switching instantaneously from automatic to manual operation.

FROEDTERT Grain & Malting Company, Milwaukee is the largest in the world with a yearly production capacity of 12,000,000 bushels and elevator and storage capacity of 9,000,000 bushels. Above is view of Hays Centralized Combustion Control panel. Arthur G. Behling was the consulting engineer on the boiler house extension.

"Through this modernization program" says Lloyd A. Corwin, Chief Engineer and General Superintendent, "operation has been improved by permitting use of low priced fuel, by increasing power and steam output and by eliminating use of live steam for process."

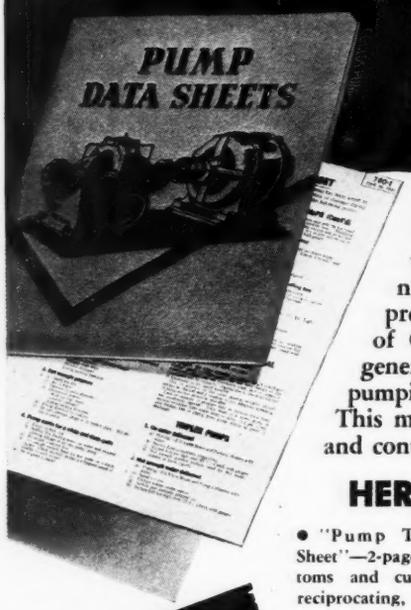
HAYS

Automatic
COMBUSTION CONTROL
THE MODERN SYSTEM—*it's Electric!*

THE HAYS CORPORATION • • • MICHIGAN CITY, INDIANA

VALUABLE PUMP DATA SHEETS

Free to anyone who selects, installs, operates or maintains industrial pumping equipment



In this Goulds Pump Data Sheets Binder, yours free for the asking, you will find a valuable selection of technical data sheets and booklets originally prepared for the confidential information of Goulds own salesmen, but now made generally available to help you "keep 'em pumping" at top efficiency for the duration. This material applies to all makes of pumps and contains no advertising.

HERE'S WHAT YOU GET!

- "Pump Trouble Check Sheet"—2-page list of symptoms and cures — centrifugal, reciprocating, rotary.
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- "New Pump vs. Old Pump"—2-page sheet showing how to figure operating costs, correct pipe sizes, etc.
- "Boiler Feeding & Hot Water"—8-page pamphlet telling how to figure capacities, heads, select proper pump, etc.
- "Centrifugal Boiler Feed Pumps"—4-page folder of instructions, tips on operation and maintenance for best performance.
- "Pump Fundamentals"—18-page elementary handbook on types of pumps, uses, and installations.

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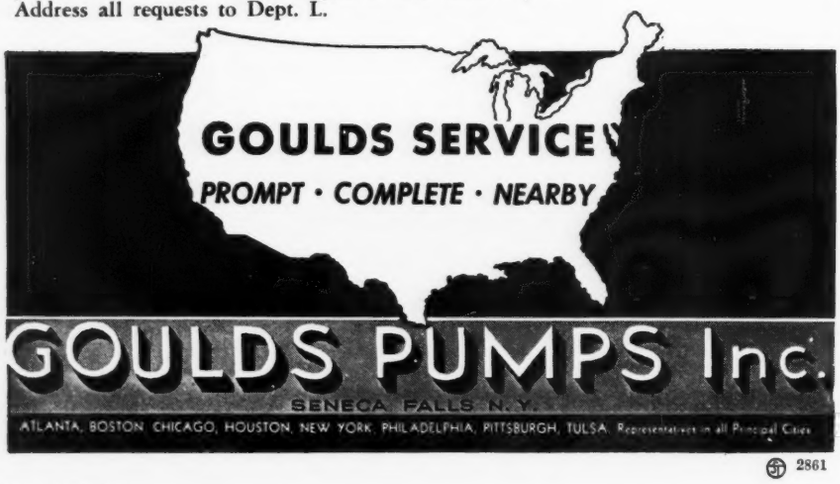
Because these binders (durable file folders containing an extra pocket for your own notes) and sheets are costly, please request just one binder. If, after receiving it, you wish extra copies of any sheet, booklet, or the entire binder to help you train new men, we will be glad to send them to you. Address all requests to Dept. L.



GOULDS PUMPS Inc.

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inforcing rivets provide added strength and longer garment life. *American Optical Co, Southbridge, Mass.*

Pump Tank Extinguishers

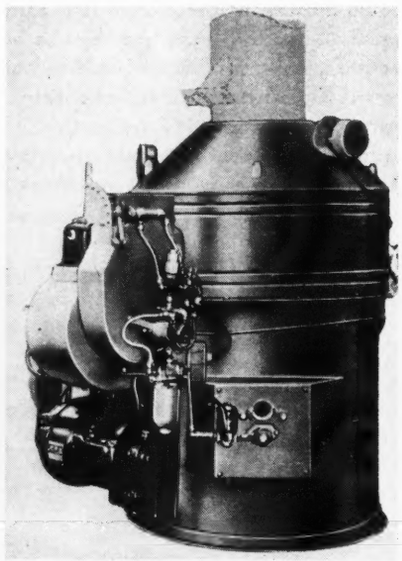
BUFFALO PUMP TANK EXTINGUISHER has been designed to meet the hazards of incendiary bombs. A fine water spray, or a solid stream provides effective control. Units have dependable double-action pump and a large refill opening at the top to facilitate quick replenishing of water during operations if necessary. Made in capacities of 2½ and 5 gallons. Extinguishers also may be used with special non-freeze solution for unheated buildings. *Buffalo Fire Appliance Corp, 44 Central Ave, Buffalo, N. Y.*

Insulating Varnish

FLAME-RESISTANT INSULATING VARNISH designated R-878 is recommended for class B high-temperature insulation. New varnish said to be mechanically strong and to dry all the way through when applied to electrical apparatus. After drying, R-878 will not support combustion, when flame is removed, or melt or resoften under operating temperatures. In addition to good heat-resisting qualities, it is said to have characteristics of high grade insulating varnish. *Sterling Varnish Co, 165 Ohio River Blvd, Haysville, Pa.*

Steam Generator

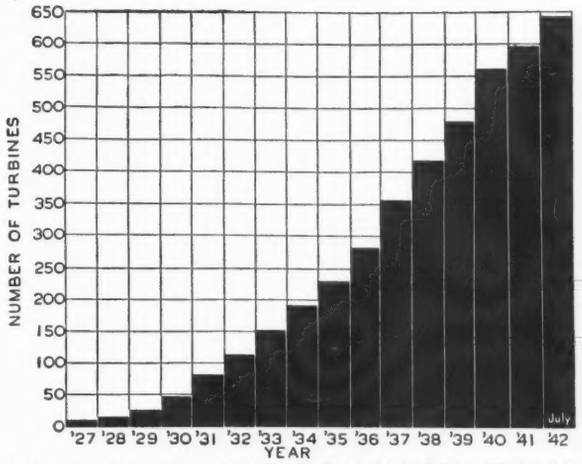
"RECIRCULATED"-TYPE STEAM-GENERATING UNIT said to be capable of producing steam from a cold start to pressures up to 300 psi in less than two minutes. Available in standard "packages" of 500, 1000, 1500, 2000, and 3000 lb evaporation per hr. Unit requires no



Facts about TURBINE OIL OXIDATION AND SLUDGING

. . . AND INHIBITORS THAT PREVENT THEM

These facts about the prevention of turbine oil oxidation through the use of Nonpareil Turbine Oil, an inhibited oil, are based not merely on laboratory studies. They have been proved under actual operating conditions, in some turbines for as long as 15 years. The number of Nonpareil users has grown steadily, as shown by the chart at right.



NUMBER OF TURBINES OPERATING ON NONPAREIL TURBINE OIL

CAUSES OF TURBINE OIL OXIDATION AND SLUDGING

Petroleum oils are extremely complex mixtures of hydrocarbons which differ widely in their resistance to oxygen absorption or oxidation. Unstable hydrocarbons when left in a turbine oil form numerous types of oxidation products. Asphaltenes and organic acids are the most common.

Asphaltenes tend to precipitate as sludge, while both asphaltenes and acids serve as emulsifiers in the presence of moisture. The acids also may attack metal surfaces, forming metal soaps which settle out of the oil and deposit in low temperature areas in lines, coolers, etc.

PROBLEM OF REFINING TURBINE OILS

While it is possible by refining processes to remove the asphaltene-forming, unstable hydrocarbons from a turbine oil, such rigorous treatment may destroy much of the lubricating value of the oil—a factor called "oiliness"—and render the remaining hydrocarbons peculiarly susceptible to rapid acidity development.

We know of no *refining* process alone that will prevent acidity development as a result of oxidation in oils. This can be accomplished only by first removing the asphaltene-forming hydrocarbons and then stabilizing the remainder with suitable antioxidants or inhibitors.

OXIDATION CONTROL IN NONPAREIL

NONPAREIL TURBINE OIL receives its freedom from *sludge deposits* by a special process of refinement which does not impair its lubricating quality, and its freedom from *acidity increase* by the use of *patented* inhibitors which are stable and free from deleterious effects.

Although the antioxidants in NONPAREIL are very slowly consumed in service, as are all antioxidants, they are automatically replenished by the addition of makeup oil normally added to overcome losses due to evaporation and leakage.

SERVICE RECORDS PROVE NONPAREIL OVERCOMES OXIDATION AND ACIDITY

Accurate service records from 640 turbines operating on Nonpareil prove that excessive acidity, oxidation, and sludge formation are completely eliminated where simple filtering or centrifuging equipment is used to keep foreign contaminants out of the oil and where a small amount (usually 10% per year) of makeup oil is added to replenish the inhibitors. There are many installations where Nonpareil has been in service from 10 to 15 years without batch treatment, resting, or replacement, and where its neutralization number is still 0.05 mg. KOH/gm. Acidity in Nonpareil is *guaranteed* not to exceed 0.15 for the life of your turbine.

A Standard Lubrication Engineer will gladly answer any further questions you may have about Nonpareil. Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the Engineer nearest you.

NONPAREIL TURBINE OIL

1. Stability Against Oxidation and Sludge.
2. Non-Corrosive. 3. Good Demulsibility.
4. Proper Viscosity Grades.

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIANA)

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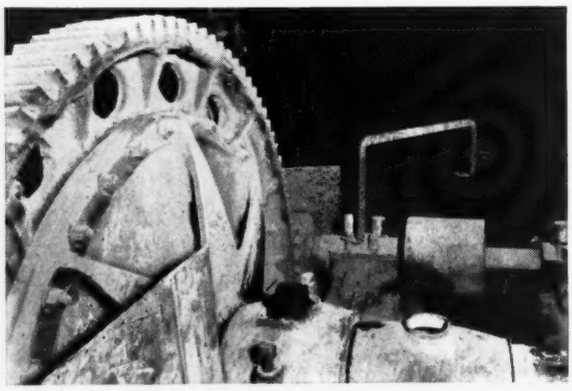
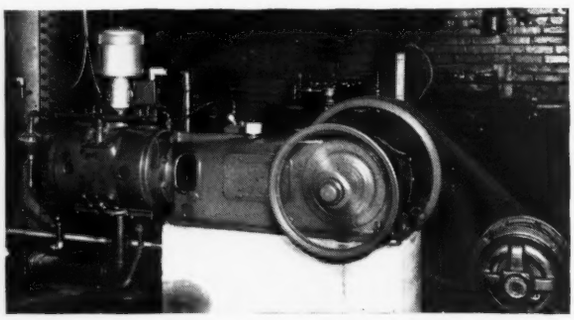
...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATI

HOW BETTER LUBRICATION HELPS REDUCE SHUTDOWNS

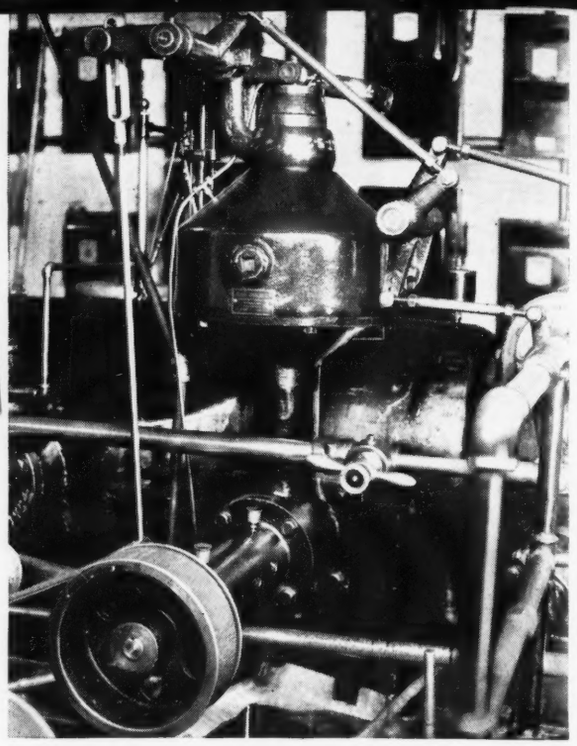
● OVERHEATED BEARINGS—sticking compressor valves—sluggish governor operation on steam engines—excessive wear on machine clutch rings. These are the problems, briefly outlined here, which Standard Lubrication Engineers have solved, to help harried plant men keep their equipment producing. They're just a sample of the many ways these Engineers have reduced maintenance, shutdowns, and delays through recommending lubricants and lubricating methods to meet today's demands on plant equipment. These examples may suggest ways an Engineer can help you.



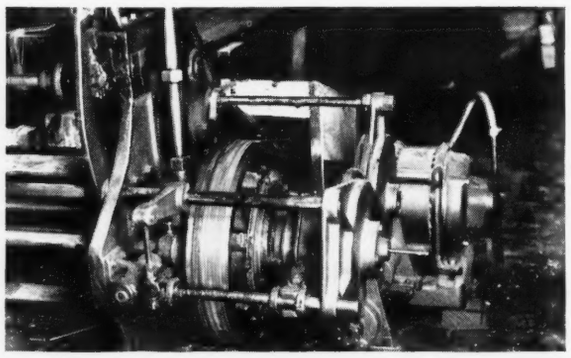
TUBE MILL BEARING TEMPERATURES were high—250° to 300° F.—because of friction of iron pellets used to finish grinding the cement in the mill. Two plain bearings supported the 40-ton loaded mill. The grease used was rapidly consumed. It failed to give adequate protection. A Standard Engineer's recommendation—STANOLIND MILL GREASE—was tried. Consumption was cut in half, with perfect lubrication of the bearings, even at the high temperatures.



STICKING COMPRESSOR AND UNLOADER VALVES caused by gummy deposits from oil, in a compressor similar to the unit pictured above, required considerable time out for cleaning. STANOIL was one of the oils tested to eliminate the trouble, and in spite of slightly higher price, was finally adopted. Stuck valves were eliminated and maintenance costs reduced. This reduction, with the reduced oil consumption, easily offset the slightly higher price of STANOIL.



GOVERNOR OPERATION WAS ERRATIC on a Corliss engine. Examination showed sludge deposits in the governor casing. Again, STANOIL—a highly stable oil—was recommended by the Lubrication Engineer. No deposits have appeared in almost a year. More flexible operation of the governor enables the engine to meet fluctuating loads.



CLUTCH RINGS ON A MACHINE DRIVE had to be torn down and cleaned every 30 days to remove resinous deposits. Even then, rings failed frequently. After changing to SUPERLA GREASE—a Lubrication Engineer's suggestion—there have been no ring failures in six months. Inspections show no deposits and no hardening effect on the rings due to lack of lubrication.

HERE'S WHERE YOU'LL FIND A STANDARD OIL ENGINEER

Call any local Standard Oil Company (Indiana) office in the middle western states listed below, or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

COLORADO • ILLINOIS • INDIANA • IOWA • KANSAS • MICHIGAN
MINNESOTA • MISSOURI • MONTANA • NORTH DAKOTA • WYOMING
SOUTH DAKOTA • WISCONSIN

OIL IS AMMUNITION . . . USE IT WISELY

STANDARD OIL COMPANY (INDIAN

For Victory —USE QUALITY MATERIALS

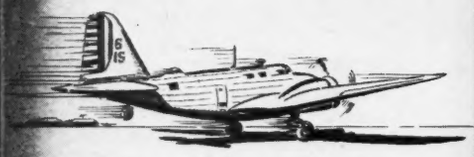
BUY U. S. WAR BONDS

To get the most out of your packings, gaskets and oil seals, insist on *quality* at the start . . . and be sure you use the proper material for each requirement. A Garlock representative will gladly advise you about this.

GARLOCK

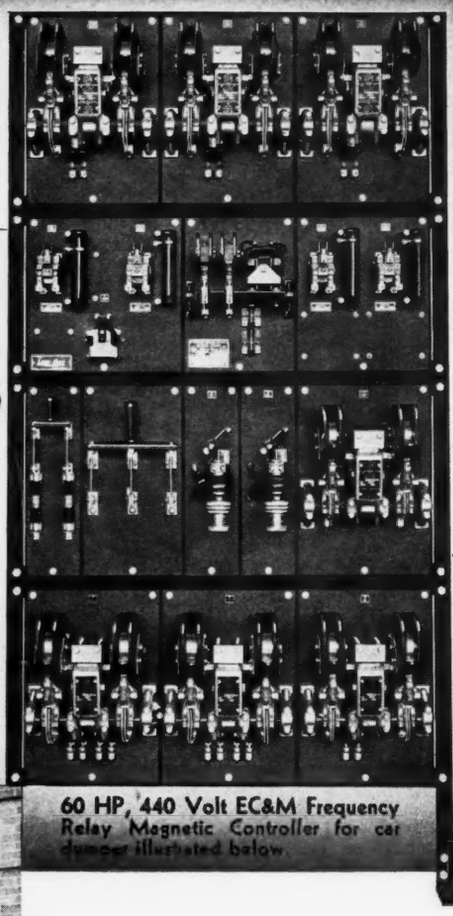
THE GARLOCK PACKING COMPANY, PALMYRA, N. Y.

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

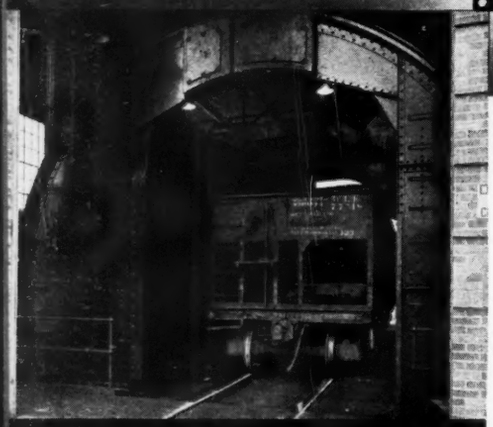


Smooth Acceleration

EC&M FREQUENCY RELAY MAGNETIC CONTROL



60 HP, 440 Volt EC&M Frequency Relay Magnetic Controller for car dumper illustrated below.



End view of Wellman Engineering Co. Rotary Car Dumper recently installed in north-central power generating station.

Car Dumper in extreme dump position. Limit Switches provide slowdown and stop at both limits of travel.

FROM standstill on the runway until the wheels leave the ground, the modern airplane increases in speed uniformly and smoothly over the entire distance required for the take-off.

Likewise, EC&M Frequency Relay Magnetic Control brings a-c wound-rotor motor-driven machines up to speed equally as smoothly and uniformly from the instant power is applied until the motor is running at full speed.

Besides being easy on the motor . . . and easy on the machinery during acceleration, this control can be designed to meet specific torque requirements for certain starting conditions such as encountered in wire drawing. In this instance, proper secondary resistance is chosen to give suitable starting and accelerating torque which will eliminate wire breakage and EC&M Frequency Relay Acceleration matches these pre-selected values to the load for smooth, safe acceleration.

Ask for Literature No. 930 on EC&M Frequency Relay Magnetic Control.

EC&M Frequency Relay Acceleration matches motor torque to the requirements of the load.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

THE ELECTRIC CONTROLLER & MFG. CO.

CLEVELAND OHIO

boiler room or high draft stack and is completely automatic or semi-automatic according to specified requirements. Staggered steel tube-coil assembly is easily removed for cleaning. Fully compensated for expansion and distributes hot gases with exceptionally high thermal efficiency. Single motor drives all accessory units with water blower and fuel feed controlled by steam demand. Interlocked automatic regulation assures absolute safety. *Vapor Car Heating Co, Inc, 80 E. Jackson Blvd, Chicago, Ill.*

Wear Gage

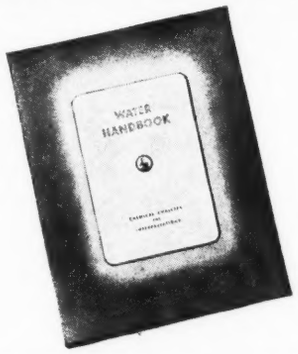
WEAR GAGE IS FOR MEASURING precisely amount of material removed from metallic surfaces after such surfaces have been subjected to wear, abrasion, grinding, honing, lapping, etc., as in engine cylinders and pistons, crankshafts and bearings, cams, cam shafts and bearings, push rods, gears, etc. Maximum

amount of wear that can be measured is 0.0014 in. Minimum detectable wear (sensitivity) is 0.000015 in. With this gage measurements can be made on the inside surfaces of cylinders having a minimum diameter of 2$\frac{3}{32}$ in.; on flat surfaces; on the outer surfaces of cylinders down to $\frac{3}{32}$-in diameter; on spheres down to $\frac{1}{4}$ in. diameter. *American Instrument Co, Silver Spring, Md.*

Cooling Unit

YOUNG QUAD ATMOSPHERIC COOLING UNIT resembles a 14-ft tower with a base approximately 12 ft square. The unit's sides are heat transfer surfaces for water, oil or gas cooling and for steam or vapor condensing, as required. High-capacity induced-draft fan is mounted horizontally at top of tower, drawing air through the heat-transfer elements and discharging it upward through an aero-dynamically designed discharge stack. It is possible with this unit to cool a diesel engine of ap-

but UNFIT for Industrial Use!



WATER HANDBOOK—*complete treatise on water treatment, containing methods of analysis and interpretations of results for plant control — Price 50 cents.*

Water that is just right for sailing — or fishing — or swimming — generally proves unsatisfactory for power or processing needs unless properly conditioned.

The right water for any particular industrial application is a matter of careful and continuous treatment and control. W. H. & L. D. Betz is an organization of engineers and chemists, trained and skilled in the correction and conditioning of one universal raw material—WATER. Betz service includes consultation, plant studies, plant design and service supervision for boiler, process and municipal water, as well as waste and sewage disposal.

Under increased production schedules proper water conditioning is more important than ever before. Betz offers complete facilities and services in the solution of all water problems.

W. H. & L. D. BETZ

Consultants on ALL Water Problems

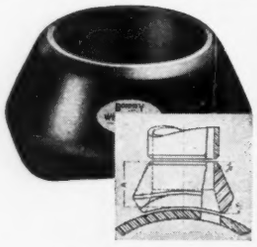
FRANKFORD • PHILADELPHIA • PENNSYLVANIA

LABORATORIES AND ENGINEERS LOCATED THROUGHOUT U.S.A. AND CANADA

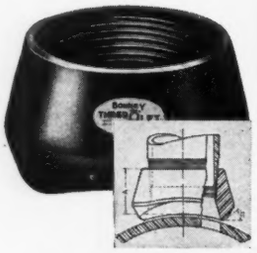
WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
Welded Outlets for Every Piping System

How to Make Any Right-Angle Welded Branch Pipe Outlet in 6 Easy Steps

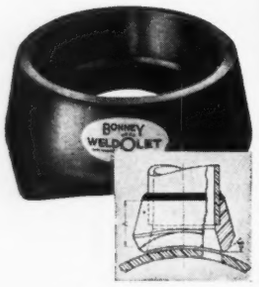
WITH Bonney WeldOlets, ThredOlets and Socket-End WeldOlets you can speed up installation of new piping systems . . . make new branch outlets in existing systems faster than any other way, in many cases without even removing the main pipe. Any right-angle, welded branch pipe outlet can be made in 6 easy steps with these fittings . . . a stronger, better outlet obtained than with any other method. Here's how it's done.



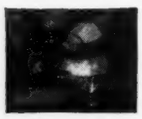
WELDOLET



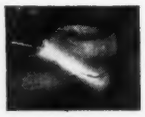
THREDOLET



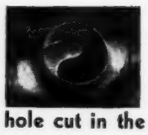
Socket-End WELDOLET



1 Select the position of the outlet. Rub the fitting over the pipe several times at the position of the outlet to remove scale and dirt. Then mark center lines and tack into position.



2 Tack in a sufficient number of places to insure its desired position. No clamps are necessary. Then weld, following and filling the bevel along the base of the fitting. A junction of full pipe strength results.



3 Then remove the button with the torch, a hole saw or by drilling. Where the outlet is smaller than 2" . . . or under unusual conditions on the larger sizes, the fitting should be used as a templet and the hole cut in the main pipe first.

4 After the fitting is installed on the main pipe and the button removed, the inside of the joint is in full view for inspection . . . impossible with a junction made in any other way . . . or with any other type of fitting. Icicles, scale and excess welding metal are eliminated. They are removed with the button.

5 The branch pipe is then attached to the outlet of the fitting . . . by welding, if a WeldOlet or Socket-End WeldOlet is used . . . or simply screwed into position if a ThredOlet is used.

6 The job is then complete. Note the trim, mechanical appearance. A leakproof junction of full pipe strength has resulted without the use of templets or complicated forming and fitting.

WeldOlets, ThredOlets, Socket-End WeldOlets . . . because of their patented design . . . improve flow conditions, reduce turbulence and friction to a minimum.

Made of drop forged steel, they are available from stock for all standard pipe sizes for every type of piping installation and for all commonly used pressures and temperatures. Also furnished on special order in Toncan Iron, wrought iron, Monel, Everdur, etc. to meet special conditions. Bulletin WT-31 . . . just off the press . . . tells all advantages . . . is yours for the asking. Write for a copy today.

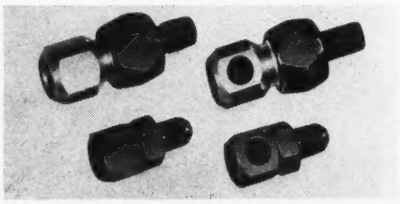
Bulletin WT31 - a 16 page catalog covering every feature of these fittings in complete detail and showing many of the various types of installations.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

proximately 2000 hp capacity handling both the engine-jacket water and lubricating-oil cooling load at a horsepower expenditure of under 25 hp. One design feature is method of subassembly employed whereby the component side members are individually assembled and supported for easy handling the entire unit being erected at point of operation with the various sides bolted into their respective positions. *Young Radiator Co, Racine, Wis.*

Straight and Angle Swivels

STRAIGHT AND 90-DEG ANGLE SWIVEL is used in making oil, grease, air and other line connections between stationary and revolving, oscillating or other moving surfaces. Swivels are available in two constructions for different requirements. Standard ball-bearing swivels are available in ⅛-, ¼-, ⅜-, ½-, ¾- and 1-in. pipe sizes. Swivels turn freely at any pressure be-



cause of their ball-bearing construction and should be used if space permits. Stem and nut on which the balls turn are hardened to minimize wear. Light-duty swivels are built without balls and are intended for lighter work when space limitations do not permit standard ball-bearing swivels. Units without balls are offered only in ⅛- or ¼-in. pipe sizes. *Trabon Engrg Corp, 1814 E 40th St, Cleveland, Ohio.*

Welding Electrode

ARC-WELDING ELECTRODE has been produced expressly for use with "Fleet-Fillet" technique of arc welding, recently announced by the company. Electrode is designed to obtain maximum benefit from the new technique in welding speed. Fleetweld 11 is not only a fast-flowing electrode, but it gives deeper penetration of metal into the root of the joint. It is a shielded-arc electrode heavily coated to exclude oxides and nitrides from the weld. In a demonstration, the new electrode welded in 35 seconds a joint that required one minute and 17 seconds with conventional electrode and ordinary procedure. *Lincoln Electric Co, Cleveland, Ohio.*

EXACT CONTROL IS *Vital*..

— to maintain consistently uniform quality in the manufacture of Globe Steel Tubes. A large and fully equipped chemical and physical laboratory, manned by graduate metallurgists, is basic to the exact control of production maintained at Globe Steel Tubes Co.

GLOBE TUBES

In addition to the most advanced machinery and methods in the mill, under the direction of a large staff of experienced engineers and technicians, the Globe Steel Tubes Co. laboratory is another important factor which contributes substantially to the inherent quality of Globe Steel Tubes . . . quality which has won them high recognition with utilities, leading railroads, industrial and marine boiler builders.

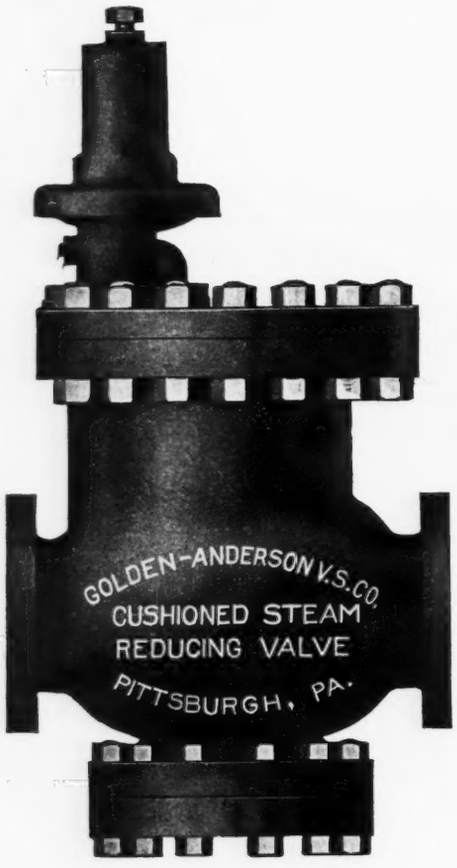
GLOBE STEEL TUBES CO.
MILWAUKEE, WISCONSIN

GLOBE STEEL TUBES

STAINLESS TUBES • BOILER TUBES • CONDENSER AND HEAT EXCHANGER TUBES • MECHANICAL TUBING . .

5000

GOLDEN-ANDERSON
SPECIALTY Valves



STEAM PRESSURE REDUCING

To insure a uniform terminal pressure on varying capacities, employ this superior G-A Steam Pressure Reducing Valve. It is particularly adaptable for intermittent or dead end service. Furnished in sizes ranging from 2½" to 12" it is of Double Extra Heavy cast iron, with a semi-steel, or cast steel body and bonnet. Trim consist of either bronze, monel metal or stainless steel. Efficiently handles 125 lbs. to 400 lbs. of saturated or superheated steam. Pilot control may be located remotely from the main valve. For a free copy of the latest G-A catalog . . . write today . . . it contains detailed construction and application data on the complete line of Golden-Anderson Specialty Valves.

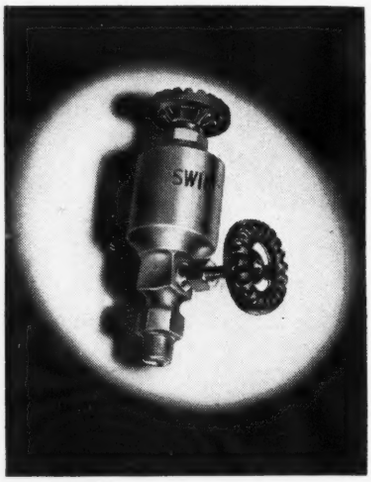
also

Altitude Control . . . Throttle and Emergency Stop . . . Check . . . and other types of valves.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BUILDING • • • PITTSBURGH, PA.

Steam Cylinder Lubricator

LUBRICATOR is designed for occasional lubrication of steam cylinders with a graphite-beeswax compound where regular steam-cylinder oil is objectionable. Lubricator used extensively on steam lines of steam-driven pumps, fans, engines, generating sets, winches, hoists and other marine auxiliaries. The body of the unit is made from high-pressure-steam bronze composition and valves are equipped with self-cooling iron handles. It has a capacity of 2½ oz with either ⅜- or ¼-in. thread shank. *Swift Lubricator Co, 330 James Bldg. Elmira, N. Y.*



Argument Corner

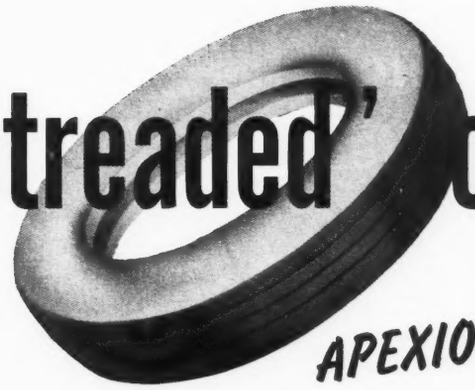
(*Continued from page* 128)

Watch Your Step When Making Welded Repairs

From time to time there appears in *Practical Aids* an article describing a welded repair to a machine part, apparently undertaken or supervised by a plant operator. Unless the actual repair was made with greater precautions and attention to details than indicated, someone is likely to be in for an unpleasant surprise as the part may break again after a period of service. Human nature being what it is, it is doubtful that the slightly red-faced operator would write to tell POWER about the welded part that broke, and thus warn or discourage similarly inclined engineers.

Because of priorities, which will probably become increasingly stringent, and the difficulty in obtaining replacement parts, more and more plant operators will make repairs by welding to expedite the return of disabled ma-

"Retreaded" or the duration



APEXIOR keeps border-line boilers in service indefinitely

Like those precious tires you are retreading for longer service, boiler tubes and drums *must* be guarded for extended operation . . . What man can foresee when new power equipment will be readily available?

Any boiler — now inactive or even nearing condemnation — that can withstand the required hydrostatic test after being cleaned, can be APEXIORIZED and kept in continuous service with reasonable care.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

A Durable, Renewable Surface

APEXIOR No. 1 puts a protective, added wearing surface on bare boiler metal. *This* surface, instead of the metal, takes the beating and resists corrosion — a surface that can be easily renewed with a hand brush or a power coater. Scale cannot bond tightly with an APEXIORIZED surface, brush-cleaning is simple and quick.

APEXIOR Guarantees Good Metal Condition — no other protection offers the same assurance and security

For years, APEXIOR has been used on steam boiler and turbine equipment by men who demand the utmost in power plant protection and efficiency.

Now — if never before — you should investigate the APEXIOR method of keeping old equipment alive, and ensuring maximum service from new installations.

Recommended by all U. S. and Canadian boiler insurance companies

Write for Bulletin 1290

APEXIOR REG U.S. PAT. OFF.

These tubes and the drum metal have been coated with APEXIOR No. 1 by unskilled help in a small plant. They can be cleaned with a wire brush. No new tubes will be needed as long as the coating is maintained.

A single coat re-application every two or three years with a hand or rotating brush will keep this boiler in efficient service for a long time to come.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

HYDE PARK · BOSTON · MASSACHUSETTS

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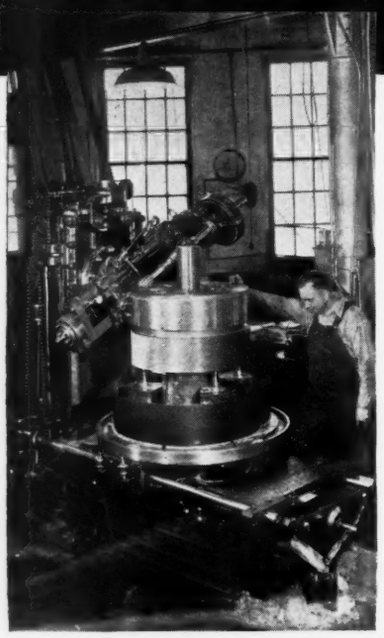
Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

Strict attention to lubrication insures longer life and better performance of your MURRAY TURBINES



Picture shows gear-cutting of herringbone gear used in connection with geared turbo-generators or geared mechanical drive turbines for fan or centrifugal pump drive.

• Keeping your MURRAY Turbines well lubricated is not a complicated nor involved process. On all these units the lubrication system has been designed to provide the utmost in simplicity, accessibility, and automatic, foolproof operation. In the achievement of these features no sacrifice of the basic purpose has been made to furnish uniformly effective oiling under all conditions of speed, load, steam pressure, or temperature. The precautions are few and simple but extremely important to successful operation and decidedly longer life of your units.

• **CLEANLINESS: It is essential to guard against impurities gaining entrance and contaminating the oil. OIL TEMPERATURE: As oil temperature rises, the tendency of the oil to oxidize and deteriorate is accelerated—we suggest that a careful check be kept on your oil temperature. OIL PRESSURE: The oil pressure provides an index to the proper operation of the system as a whole—all pressure changes, sudden or gradual, should be investigated. OIL LEVEL: To neglect the oil level in bearings or supply tanks is to jeopardize all other good work done toward maintaining correct lubrication. FOAMING: Breakdown of generator insulation, short circuits, etc. result through escaping oil due to foaming. On some installations it has been found that a slight reduction in the pressure at which oil is circulated will be beneficial—on others the correction has been accomplished by reducing the flow of water through the cooler and circulating the oil at a slightly higher temperature. Lack of oil is a likely cause of foaming. Adding too much new oil to the system at one time is another cause. SLUDGE: Possibility of this formation is minimized by using a high grade oil and keeping system free from impurities. DRAINING: Regular draining and renewal of the lubricating charge is essential to continued efficiency in lubrication.**

Our Bulletin T-120 gives you details on all these points and makes other valuable suggestions.

BOILERS TURBINES ENGINES

MURRAY IRON WORKS COMPANY

INCORPORATED 1870

BURLINGTON IOWA

chines to service. Before proceeding with such repairs, consideration should be given to certain details.

Ordinarily, low-carbon steels, up to about 0.35% carbon, present no difficulty if welding is performed by a capable operator using a proven technique. Preheating is not usually necessary and stress-relieving or normalizing is employed only if the part is of heavy section, of intricate pattern, or to be used for some special or severe service. Even then stress-relieving is applied only to relieve the locked up stresses caused by welding, and does not restore any physical or metallurgical qualities to the part. These characteristics are not appreciably affected by proper welding procedure. Thus, welding repairs can be made readily on low-carbon steel parts and if properly done the finished job should have all the physical properties of the original piece.

As the carbon content increases, greater difficulty is experienced in obtaining a satisfactory weld because of the hardening effect of the carbon. Cracks may develop both during and after the welding, either in the weld or adjacent to it, unless a suitable welding technique is employed. Precautions such as preheating, laying of beads, and control of cooling rate together with the use of a highly ductile electrode are usually necessary, so that the stresses will be set up in the deposited metal and not in the base material.

Mechanical Treatment

In addition to the inherent difficulties caused by high-carbon content, machine parts may also have received mechanical treatment such as forging or rolling; or heat treatment such as carburizing, nitriding, or tempering; all of which were for the purpose of giving the piece certain definite characteristics. Even ordinary cold-rolled steel may be difficult to weld satisfactorily because of the presence of sulphur. This increases machinability but decreases weldability because sulphur has a tendency to cause porosity and therefore an inferior weld.

Furthermore, various percentages and combinations of alloying elements such as chromium, nickel, vanadium, tungsten, molybdenum, or silicon, may have been added to make the steel resistant to impact, corrosion, or abrasion, or for refining the grain structure.

When these metals are welded the high temperature destroys the effect of the treatments they were given and may destroy the effects of the alloying elements. As a result, after welding the material will have few if any of the

40 MEN AND A JEEP

"GETTING there fustest with the mostest men" is still rule one for winning a battle. Today's wars depend upon the speed with which troops and their fighting equipment can be moved to the place where they are needed.

Rolling off production lines in America's great aircraft factories are huge freighters of the airways—planes as big as a boxcar that can span a continent between daylight and dark.

These leviathans of the air owe their tremendous carrying capacity as well as the speed with which they fly to the giant engines that power them.

To transmit the power of thousands of horses to whirling propeller blades, the gears in these engines must of necessity be held to such close tolerances that engineers have long considered them a laboratory product.

But laboratory methods of production could not be expected to furnish enough gears for the thousands upon thousands of fighting planes, bombers, and transports that are required to win a war.

The solution came in the production of gears of laboratory precision by mass methods, and today in the precision gear plant of Foote Bros., modern industrial might is helping solve the problem of more horsepower for engines—produced in ever-increasing quantities to meet war's insistent demands.

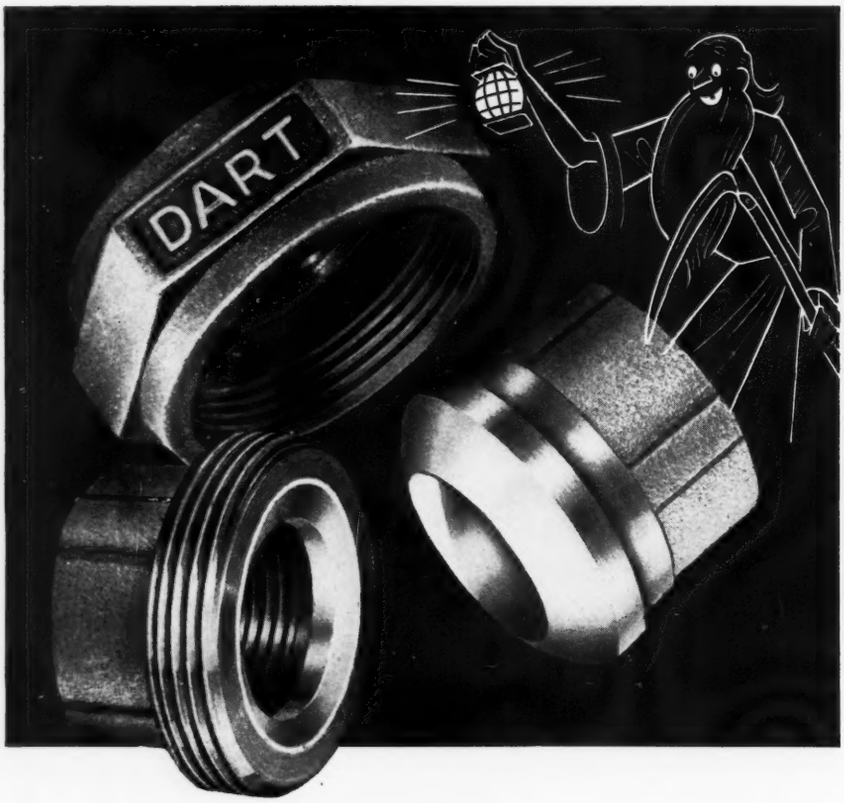
These new techniques—these new skills translated into post-war production mean that peacetime speed reducers and peacetime gears will assure better machines—quieter machines—that promise greater savings to American manufacturers.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS ★ GEARS ★ SPECIAL ASSEMBLIES

SCRAP PILES are "GOLD MINES" if they have Discarded Darts



...You Really Find something when you find Used

DART UNIONS

Just a pile of pipe scrap? Wait a second . . . take a *good* look! That scrap may contain some discarded Dart Unions—and if it does, your company is in luck . . . and the cause of metal conservation gets a good break, too. *Those discarded Darts can be put back on the job.*

Just because a Dart has seen a lot of service doesn't mean that it's through. Far from it! Dart Unions can be used again, again and *again*, giving trouble-free tightness each time. For this unusual performance, credit Dart's matched bronze seats, ground to "true-ball" surfaces . . . and the fact that Dart's air-refined malleable iron nuts and bodies resist corrosion, rust, rough handling.

It's good business and practical patriotism to team up your old Darts with the new ones available from your supplier.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

characteristics of the original part and it may no longer be suitable for its intended use.

Although there is much instructive literature outlining the methods to use in welding different metals and alloys, to be had for the asking, or at nominal cost, the operator is often at a loss to know the composition of a broken part and therefore which instructions to follow when making a repair. Alloys overlap in properties and may be used interchangeably, with cost or bias determining the choice in designing the part. While a metallurgist or welding engineer might be able to estimate with some accuracy the character of the metal in a broken part and its structure and thereby prescribe a satisfactory welding procedure, it is unlikely that a plant operator or average welder could do likewise.

The chances are that if welding in machinery repair is entrusted to service engineers or welding-equipment manufacturers, to the manufacturer of the machine, or to a responsible repair shop the welded job will be satisfactory and permanent. These organizations have available men with the expert knowledge and experience of welding engineers and metallurgists. Too often, however, the welding is done by the plant handyman or other individual who has "picked up" welding. No attempt is made to belittle the abilities or honest endeavors of these workmen in saying that they are hardly equipped to "engineer" a repair involving what may be and likely is a complex metallurgical structure.

Melrose, Mass. E MacDermod

Add New Teeth to Gear Without Welding

The item, "Builds New Gear Teeth With Bronze Welding," by A R Ciotti, in September Power reminds me of one of my own experiences. I was not fortunate enough, however, to have welding equipment, so had to do the job without it.

When you are considering drilling and tapping the rim of a gear wheel to attach new teeth there are several factors to take into account. First, the metal removed by the holes drilled in the rim weakens the rim by that much. If the holes take out half the metal in the rim cross-section, then the rim is only one-half as strong as before the holes were bored. On the other hand, if you do not use large enough pins for the teeth they will break off and may wreck the gears. Where welding is used to build up the teeth on the pins it adds

Looking ahead with Asbestos

● Just what is this material whose future in the electrical field is so confidently predicted? Physically, K&M Ebonized Asbestos is asbestos fibre and binding cement molded under pressure into sheets, and impregnated with a special insulating compound to increase dielectric strength.

More interesting to electrical engineers, though, are the qualities and characteristics that make this material ideal for switchboards, panels, bus bar supports, testing tables. It will, for instance, withstand severe shock and vibration; a sheet as thin as ¼" can be subjected to extremely high voltages without puncture; it actually becomes tougher with age.

K&M's Ebonized Asbestos cannot be freely available again until peace has come. Meanwhile, however, the K&M research laboratories continue to probe for new uses for Nature's strangest mineral, in order that the future contributions of asbestos to the world may be even greater than in the past.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer, has made it serve mankind . . . since 1873.

KEASBEY & MATTISON

COMPANY, AMBLER, PENNSYLVANIA

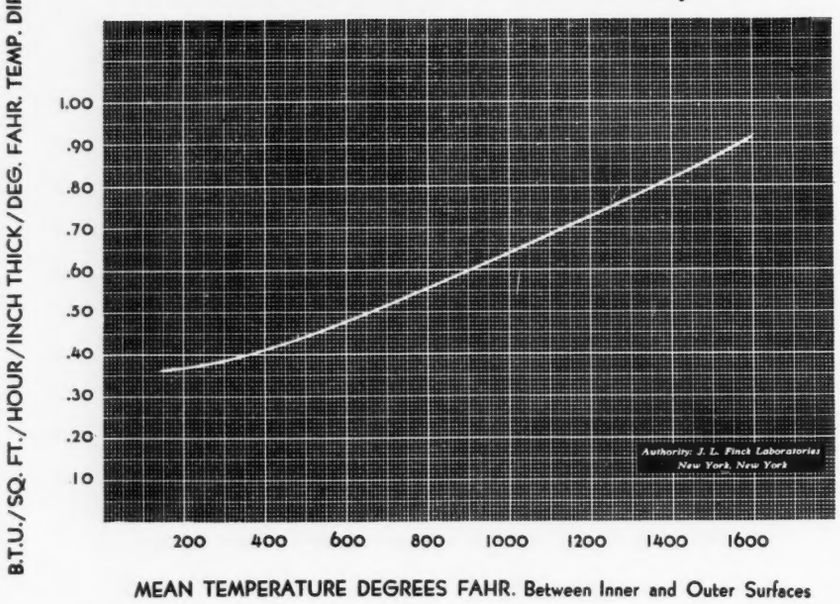
Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains

Beat the Heat Loss with

BALDWIN-HILL MONO-BLOCK

Read this Conductivity Curve



MEAN TEMPERATURE DEGREES FAHR. Between Inner and Outer Surfaces

The application of Baldwin-Hill Mono-Block to boilers, steam turbines and engines, casings and similar hot equipment will increase their power producting capacity to obtain maximum efficiency. Being effective over the full range of temperatures up to 1600° F., this one insulation, Baldwin-Hill Mono-Block, eliminates the need for two materials, as formerly used, one for low and one for high temperatures. This lowers the cost of application accordingly. Mono-Block is felted by a patented process to make a strong, lightweight block that is easily cut, fitted and applied . . . and its black rockwool fibres have a low alkalinity factor which insures its stability under severe moisture and heat conditions.

BALDWIN-HILL CO., 575 Klagg Ave., Trenton, N. J.

NEW YORK • DETROIT • KALAMAZOO, MICH.

Send for Catalog showing full line

B-H Black Rockwool BLANKET . . . B-H MONO-BLOCK
B-H No. 100 PIPE COVERING . . . B-H MINERAL FELT
B-H No. 1 INSULATING CEMENT . . B-H WEATHERSEAL
and other heat insulations effective up to 2000° F.

a certain amount of strength to the teeth and rim, if properly done.

In any event, the contour of the added teeth is at best not perfect and no doubt is subjected to hammer blows that may fatigue the added teeth when they mesh with the teeth in the other gear. This may cause early failure. There is one thing in favor of the job's success: gears are generally selected quite conservatively and therefore, under normal working conditions, may have a factor of safety of 8 or 10, so that if we cut out half of the rim metal for pin holes we still have a factor of safety of 4 or 5.

This is just what we attempted to do in the job mentioned above. There were two teeth broken out of the gear. For the teeth we selected a mild steel rod stock of a diameter slightly smaller than the tooth thickness at the flank. We cut these in sections about $\frac{1}{16}$ in linger than the length of the tooth, plus the thickness of the rim, and threaded them so that they would extend through the rim about $\frac{1}{16}$ in.

After drilling and tapping the rim we screwed the rod sections into place tightly and peened the threaded ends so the rods could not work loose. To assist in filing the rod stubs to the correct contour we made a plaster-of-paris cast of two teeth in the gear and filed the stubs to a shape that would fit this cast. When the job was completed it worked satisfactorily until we could get a new gear.

Riverdale, N. Y. ALEX GRAY

Uses Shims to Make Boiler Tubes Tight

In one of your recent *Practical Aid* articles, S M Elonka showed how he used shims to make boiler tubes tight in oversize tube-sheet holes. If the shims are cut square at their edges extreme care must be used in getting a good tight fit inside the hole, or the tube can crimp between the edges of the shim as at *A*, Fig. 1. On the other hand, if be-

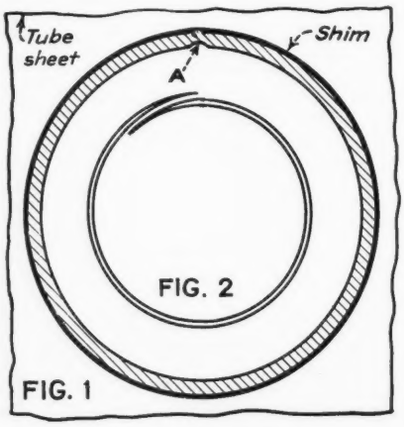


FIG. 1

One SHIFT A DAY or Three

CASH STANDARD Streamlined TYPE 1000 PRESSURE REDUCING VALVES

Go the Full Route **YEAR AFTER YEAR . . .**

Here's what happens with the Streamlined "1000" Valve on the Job

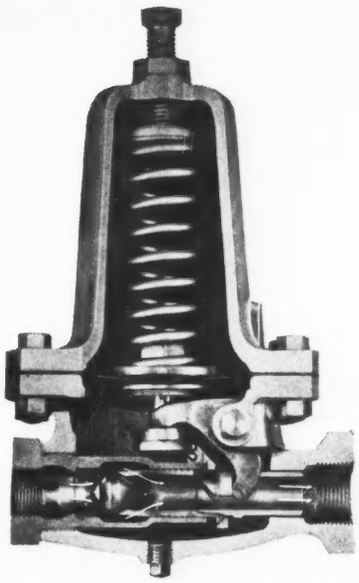
1 Maximum Capacity when needed most
2 Accurate Pressure Control under toughest working conditions
3 Trouble-free Service
4 Smooth Operation
5 Tight Closure
6 Accurate Regulation
7 Speedier Production Results
8 Elimination of failures
9 Constant Delivery Pressure
10 Cost Saving Operation
11 No Spoilage
12 Practically zero in maintenance costs

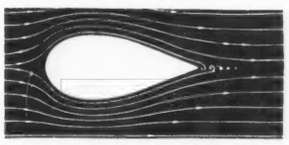
"24 hours a day"

"The particular Streamlined Pressure Regulator you refer to is installed on a paper machine making tissue paper. Pressure fluctuations are not desirable. In fact, to maintain a good, uniform quality of paper, and to get the utmost out of the machine in the way of production, sensitive pressure control is of prime importance. And because the machine runs 24 hours a day, dependability is equally important. Your valve has never missed a trick. Our operating department is well pleased." —Case No. 340.

"No trouble over a five year period"

"Bought the first '1000' Valve because we were on a hunt for a dependable Valve. Laboratory tests were so good we standardized on it. Plant use confirmed lab tests. With practically no trouble with any of these Valves over a five year period, we are not on the hunt any more."—Case No. 369.





GIVES THIS FLOW PATTERN

The Streamlined form of the inner valve eliminates turbulence. It produces the flow pattern shown above which makes for maximum capacity when it is needed most, and permits accurate pressure control under toughest working conditions.

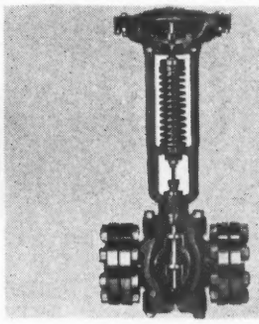
Send for Bulletin "1000"

● *Gives you full details on all of the twelve points listed above. Steam, air, and water capacity charts are shown.*

A CASH STANDARD "GET ACQUAINTED" COLUMN

Question: "Don't you people make anything besides that Streamlined Valve you talk about so much?"

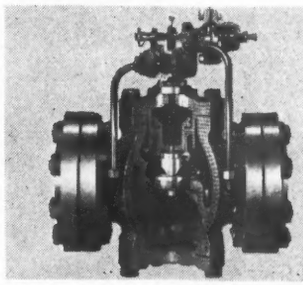
Answer: "Yes Sir; we do! And we propose to picture one or two of them here each time."



Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure, vacuum to 150 lbs.

The best that money can buy in this type valve. Precision built; every mechanical detail right as can be. Long time service. Has roller guides, roller bearing — no lost motion; a change in the pressure under control produces corrective valve movement.

Bodies: iron, bronze, steel. Trims: iron, bronze, stainless steel, monel metal. Ends: screwed, flanged, ammonia type, welding type.



Cash Standard Type 10 Pressure Reducing and Regulating Valve — self-contained, pilot operated. For holding reduced pressure within extremely close limits.

Sizes: 2" to 12" inclusive. Highest initial pressure 600 lbs.; highest reduced pressure 250 lbs. For use with water, air, Freon, ammonia; or with any non-corrosive gas or oil. Valve operating fluid not wasted; it discharges to outlet pipe.

Bodies: iron, bronze, steel. Trims: iron, bronze, stainless steel, or monel metal. Ends: screwed, flanged, ammonia type.

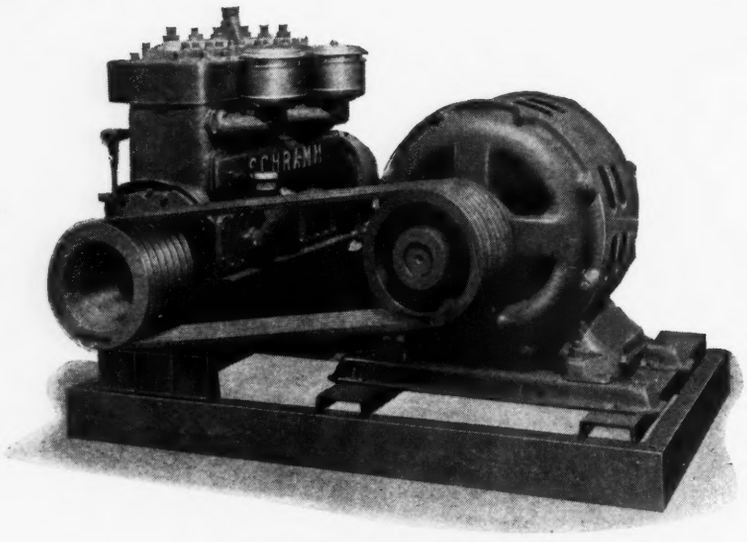
A dial on the pilot valve makes it easy to widen or narrow the control pressure range until you establish the ideal range for your service.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD CONTROLS.. VALVES

Get Free Bulletins on Above . . . Write to
A. W. CASH COMPANY
DECATUR, ILL.

A-1-A
PRIORITY ON PERFORMANCE



"V" Belt Drive On Base With Motor

• Throughout the many years of SCHRAMM operation they have been tops in performance; so now when economical, dependable and speedy performance is necessary in the present Victory drive, SCHRAMM is prepared to answer the call.

SCHRAMM Compressors are designed for heavy-duty, continuous service and will perform such service with least up-keep and operating costs. They are available for flat belt or complete "V" belt drive, "built-in" motor drive with compressor and motor assembled rigidly and in perfect alignment. Units are light, compact and easy to handle, reducing headroom and floor space requirements.

BUILT IN SIZES
from 50 to 600
Cu. Ft. Displacement

WRITE FOR CATALOG 42-S

SCHRAMM INC., WEST CHESTER, PA.

SCHRAMM *Air Compressors*

HELP DEFENSE
STOP ACCIDENTS

cause of the rolling operation the ends of the shim happen to overlap, the tube may crimp inward and cause trouble in expanding. When I do a job like this I use shims with overlapping edges filed or ground thin, Fig. 2. Then, when they are placed around the tube they make a snug fit without a break through them. A heavy grade of packing-box strap makes good shim stock.

Aurora, Col. E J DUFF

Steam Raising In Russia

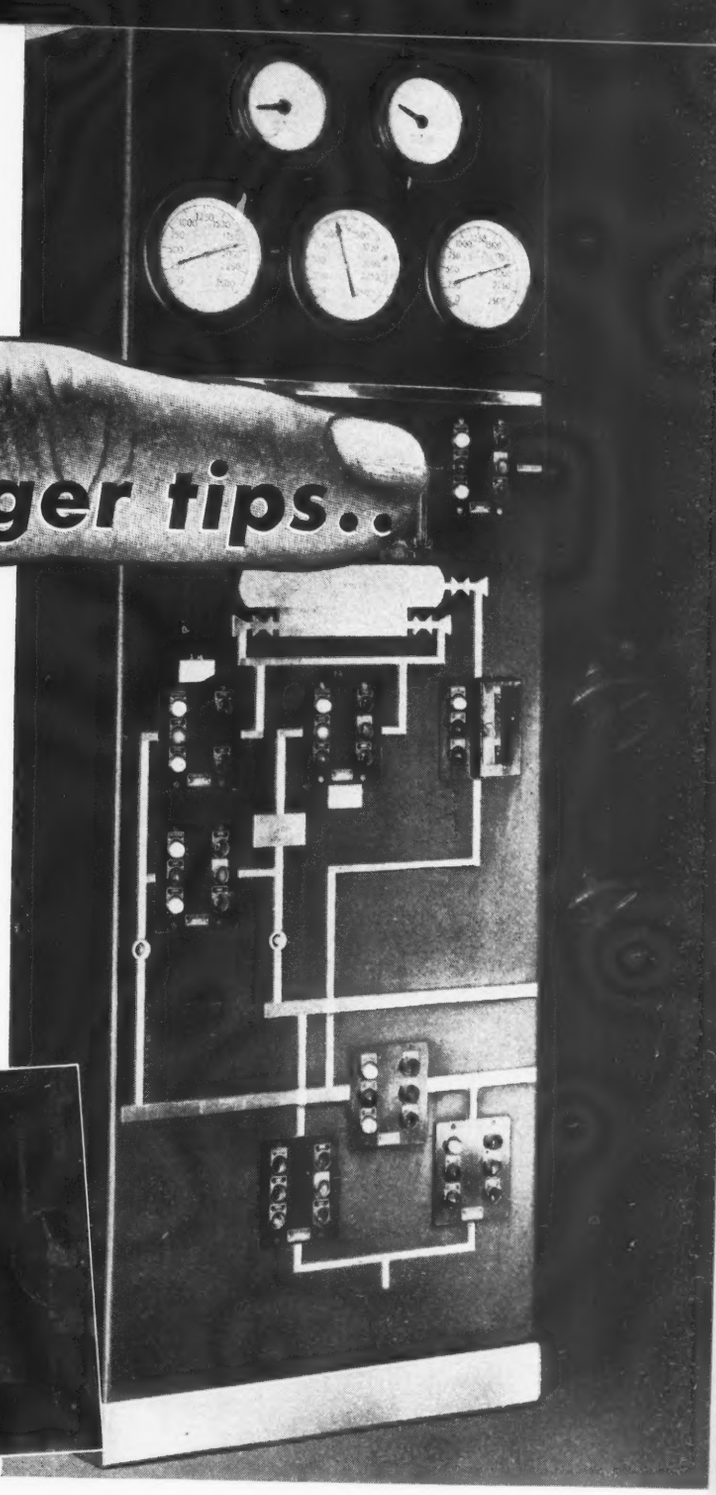
THERE ARE MANY PROBLEMS in connection with steam raising that are met with in Russia, and one can well understand why resource has been had, wherever possible, to water power. Coal is not of high grade and although wood is plentiful, transport is costly and difficult. Peat is used only for domestic fuel. But electricity is comparatively plentiful and water can be harnessed almost everywhere.

Much has been said in the daily press regarding the moving westward of munition plants and factories. Adequate hydro power is available for them although steam is provided for a standby wherever possible. Let me give an idea of one of those new factories. Clean and low built, most of the sub-buildings are separate and divided by earth or wood walls.

Open access is provided as many of the local inhabitants come in during the day to take on such tasks as can be performed by untrained labor. These people are volunteers in the strict sense

VALVE CONTROL

at your finger tips..

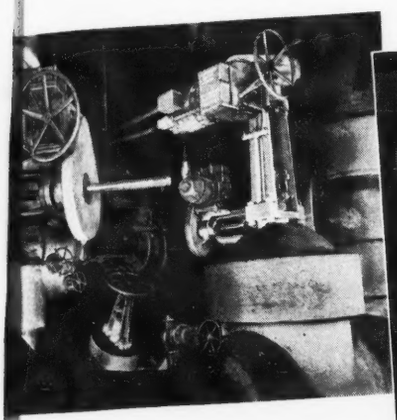


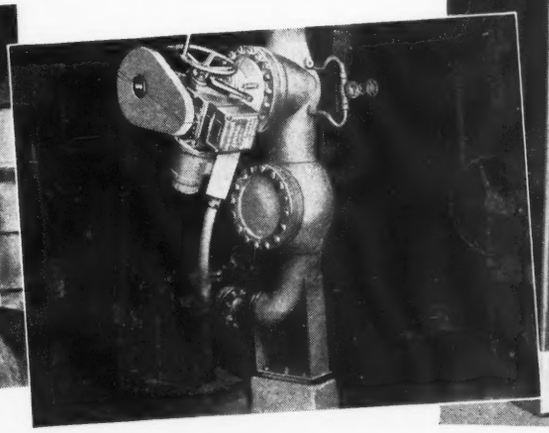
...t step up to an individual, conveniently ...ted push button station or a central ...ter control panel and you can open or ...e valves equipped with LimiTorque ...ntrols without loss of time or effort. ...ve operation can be kept in the hands ...esponsible, key workmen only.

...iTorque Controls are adaptable to all ...es of valves, from 3" to 96" diameter and can be fitted to existing equipment, if desired.

Many central stations, hydro-electric plants and private power plants throughout the country equipped with LimiTorque attest its thorough dependability in ordinary daily service as well as for emergency use.

Write us for more information.

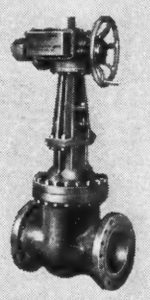




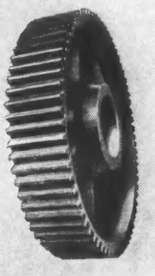
PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS AND SPEED REDUCERS
...IMITORQUE VALVE CONTROLS

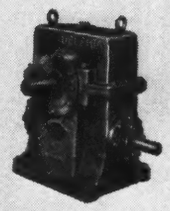
ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago



Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

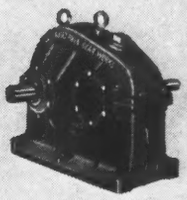


Philadelphia
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

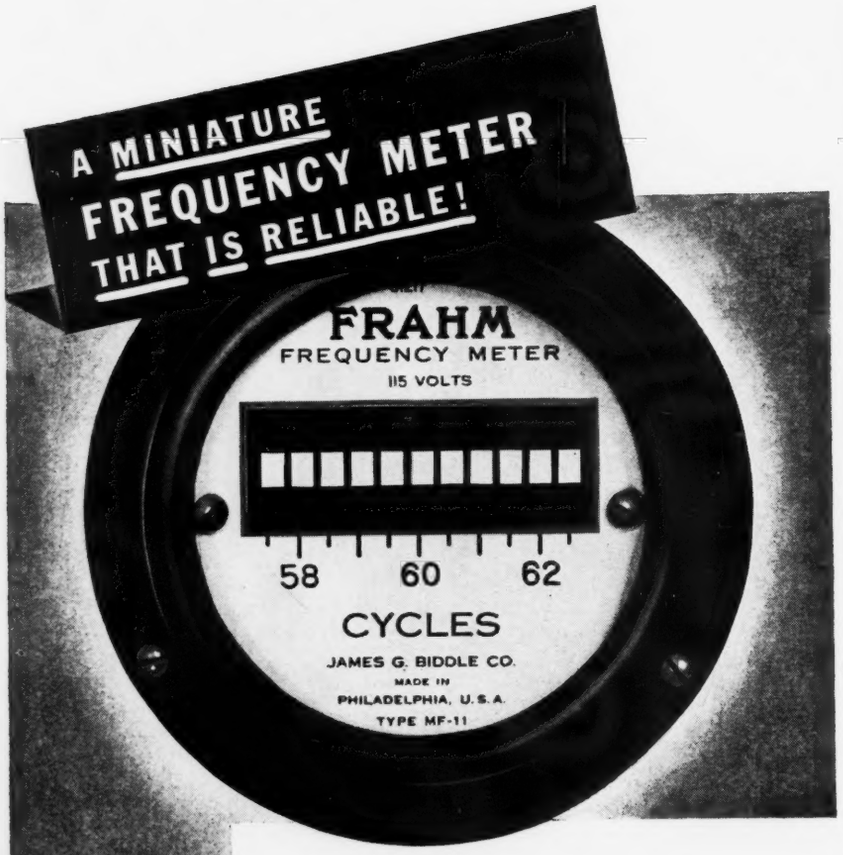


Philadelphia
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

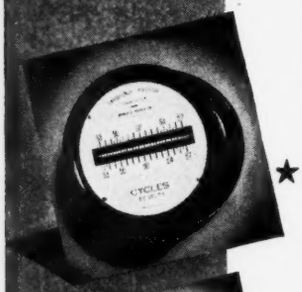
Philadelphia
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



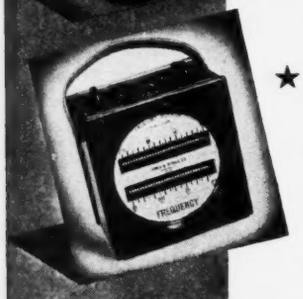
Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



This Miniature Frahm Vibrating-Reed Frequency Meter (shown actual size above) is an indicating instrument without moving system or pointer. The operating principle and the method of indication are based on resonant vibration of accurately tuned steel reeds. These instruments are easy to read, ruggedly constructed, surprisingly accurate over long periods of time and are unaffected by wave form or by ordinary changes in voltage and temperature. Available in various ranges of power frequencies from 15 to 500 cycles per second; in fact, the same instrument can have more than one range.



★ "Frahm" Switchboard Frequency Meter—9" Diameter Case. Made with one or two rows of 31 reeds each, for indicating power frequencies, also for measuring frequency of harmonic ringer circuits in telephone work.



★ "Frahm" Portable type Frequency Meter. Mounted in polished walnut case 9¼" x 8½" x 4½" overall, with carrying handle. Wide range, such as 22.5 to 90 cycles per second. Arranged for various potentials from 50 to 300 volts.

Write for illustrated Bulletin 1695-P describing all types shown.

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

of the word; no question of wages or hours enters into the matter. In every sense, they are free workers. Free to come when they please; free to go when they like. It may be thought that with labor of this kind, endless complications would arise. But every one is working free for the USSR, and all they are concerned with is keeping the Hun on the run.

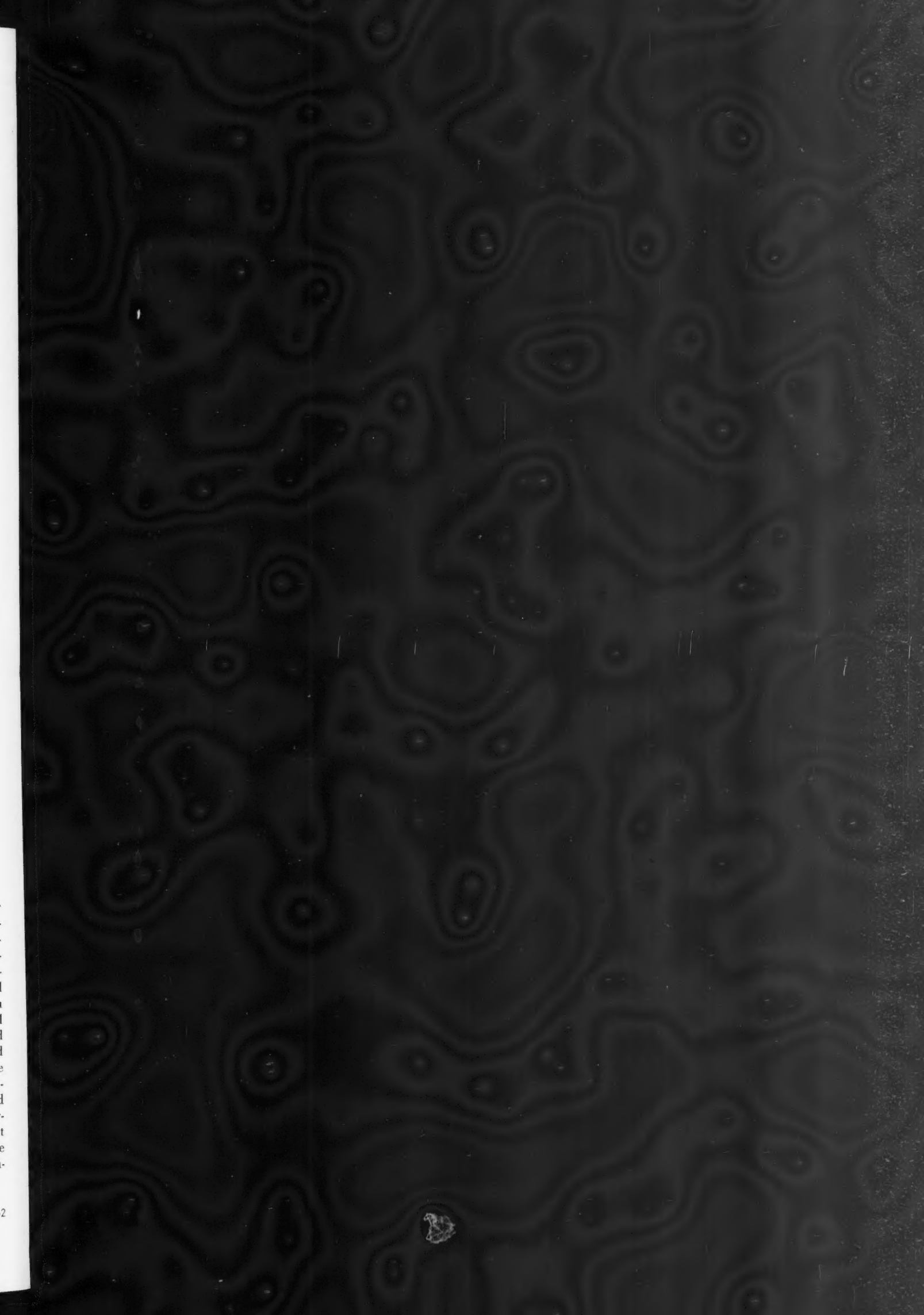
Their view is that when Hitler dared to insult holy Russia by violating their territory, he asked for all they could give, and they'll see that he gets it. Generally he gets it in the shape of empty oil tanks or bottles, which, filled with petrol, make excellent food for tanks. There is nothing refined about the feeding; scores of "mad Bolshevik hordes" rush suddenly at stationary tanks, filled with law-abiding "Aryans", and hurl petrol bottles into them. I have seen it done, and it has a most demoralizing effect. You can take it that no Blitz-Fritz is safe in entering Russia. The people are strictly neutral; they do not care who kills Hitler. They naturally prefer that it should be themselves, but so long as he is smashed together with his perverted pups, they don't really care who does the killing.

But to go back to the war factories; electricity is the chief form of power used, but most factories are fitted with steam engines or turbines and line shafting. A wandering Dornier, although there are not many of them now as the Luftwaffe has few to spare, may break a dam or wreck a power line and work must go on. More, it *will* go on even if the peasants have to come in and turn the wheels by hand.

Sevenoaks, Kent, England
G BASIL BARHAM

Contract Performance Items

Every company dealing directly or indirectly with the Army or Navy Procurement Division of the Treasury Department, as contractor or subcontractor, should procure a copy of a government pamphlet wherein may be found for the first time in printed form a definite outline of manufacturing and other contract performance items, and exceptions of an administrative and distribution nature which are allowable under contract with these three government agencies. The pamphlet, entitled "Explanation of Principles for Determination of Costs under Government Contracts," may be obtained from the Superintendent of Documents, Washington, D. C., for ten cents.



NEW CATALOGS, BOOKLETS, BULLETINS

Bring Your Equipment Library up to Date

For Your Convenience

Two reply cards are printed here as a part of this insert. On each is room to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, use the bottom card. For four to eight pieces use both cards.

2. Be sure to fill out completely one of the eight spaces for each piece you order. This will assure your receiving copies of literature promptly.

3. When you have filled out completely one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail.

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co.

Address 3718 First Avenue

Pottsville, Okla.

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

These cards not good after December 1, 1942

BOILERS AND ACCESSORIES

1 DUST RECOVERY—Buell Engrg Co, 70 Pine Street, New York, N. Y. 28-page book contains facts and data prepared by engineers in company's dust-testing laboratory. Many photographs, diagrams, tables and charts illustrate principles and practice of dust recovery, with special emphasis on cyclone collectors used in many industries.

2 FIRE BRICK—Mexico Refractories Co, Mexico, Mo. 28-page booklet covers Mono-Fibrik plastic fire brick, its advantages, methods of installation, application in lining hrt and watertube boilers, and all types of industrial and metallurgical furnaces.

3 GAS AND OIL BURNERS—Peabody Engrg Corp, 580 Fifth Ave, New York, N. Y. 4-page bulletin No. 702 describes Peabody combined gas and oil burner, for petroleum refinery furnaces, with removable gas burner ring and general air register, and oil atomizer improvements.

4 STEAM GENERATORS—Vapor Car Heating Co, 80 East Jackson Blvd, Chicago, Ill. 21-page catalog describes the Vapor "Packaged Steam" Generator and several types of valves, traps, metallic joints, thermostatic controls, heat exchanger and thermo-balancer.

ELECTRICAL EQUIPMENT

5 LIGHTING—Sylvania Electric Products Inc, Ipswich, Mass. 30-page catalog illustrates over 30 models of fluorescent lighting fixtures with technical specifications. Book also tells how to plan fluorescent installations and contains actual application photographs with general engineering and maintenance information.

6 CAPACITORS — Cornell-Dubilier Elec Corp, South Plainfield, N. J. 6-page folder weighs a familiar plant problem—overtaxed electrical systems, insufficient line, transformer and switching equipment capacity—then presents a solution that boosts factory output while saving time materials and labor.

HEATING, VENTILATING & AIR CONDITIONING

7 HEATERS—Dravo Corp, Heater Dept, Dravo Bldg, Pittsburgh, Pa. 12-page bulletin No. 506 presents tabulations, based on approximately same required Btu output per hour, show less floor space requirements for direct-fired heaters. Also demonstrates speed of installation with fewer man hours and least maintenance requirements. Explains principles of combustion chamber, heat transfer, and fuel economies.

8 COMPRESSORS — Clark Bros Co, Olean, N. Y. Booklet entitled, "Maintenance Hints for Clark 'Angle' Two Cycle Gas-Engine-Driven Compressors," considers proper maintenance and methods for solving compressor troubles. Also con-

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tains hints for reducing maintenance and repair costs.

MATERIALS HANDLING

9 MATERIALS HANDLING — Robins Conveying Belt Co, Passaic, N. J. Bulletin No. 123 covers vibrating screens for liquids, with photographs, diagrams, and tables; shows typical examples of actual applications of Robins liquid screens in reclaimed-rubber, chemical, metallurgical, and food industries.

10 LIFT-TRUCKS — Barrett - Cravens Co, 3262 West 30th St, Chicago, Ill. 4-page folder announces PowerOx, electrically operated lift truck, which combines standard line of multiple-stroke lift trucks with an electric power drive. Also contains illustrations and specifications.

11 UNIT HEATERS—Modine Mfg Co, Racine, Wis. Bulletin 142, 8 pages, features style I/S horizontal-delivery unit heaters which retain all performance and structural features that characterize the copper-condenser model. Also contains tables of constants for steam and hot water.

12 MATERIALS HANDLING — Robins Conveying Belt Co, Passaic, N. J. 12-page bulletin No. 122 features line of Vibrex vibrating screens for materials handling. Photographs, diagrams, line drawings and tables illustrate construction and dimensions of types M and J.

MECHANICAL TRANSMISSION

13 BEARING METALS — Magnolia Metal Co, 18 West Jersey St, Elizabeth, N. J. 8-page bulletin describes various lead-base metals which have proved to be excellent substitutes for tin-base bearing metals. Also contains suggestions for best results in making and maintaining journal bearings, and a table of recommendations for selecting correct bearing metal for 135 different types of machinery.

14 V-BELTS—Allis-Chalmers Mfg Co, Texrope Div, Milwaukee, Wis. 16-page pocket-size handbook entitled, "Plain Facts on Wartime Care of Rubber V-Belts," applies to all makes of V-belts and explains ways V-belt construction affects its maintenance, what determines life expectancy of a set of V-belts and what to do about worn sheaves.

15 FLEXIBLE COUPLING — W H Nicholson & Co, 12 Oregon St, Wilkes-Barre, Pa. 8-page bulletin No. 642 features Nicholson flexible coupling, its construction, functions, lubrication, strength, durability, and capacity. Also includes list of prices, dimensions and weights.

METERS, INSTRUMENTS & CONTROLS

16 MANOMETERS—Simplex Valve & Meter Co, 68th & Upland Sts, Philadelphia, Pa. Bulletin No. 200 presents type MAC portable unit and MAP Simplex manometers for measurement of water, steam, boiler feed, and industrial liquids in power and process industries. Also includes specifications, capacities, and method of connection, and reference section of manometer data.

17 INSTRUMENTS—Radio City Products Co, 127 West 26th St, New York, N. Y. Bulletin No. 126 covers new RCP instruments for laboratory and production use, such as new electronic limit bridge for precision resistance testing, and a highly versatile multitester for quick and accurate production-line tests.

18 FLOWMETERS—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia, Pa. Catalog N-28-160, 20 pages, discusses Centrimax flowmeter for steam and water, which integrates directly and records rate of flow continuously.

19 AUTOMATIC FEED CONTROL—Max Mosher, 130 West 42nd St, New York, N. Y. Bulletin deals with latest electronic control which automatically regulates feeding rate of pulverizing machines in accordance with different materials and conditions. Control warns instantly of overloading, underloading, etc.

20 GAGES—Certified Gauge & Instrument Corp, 34-18 Northern Blvd, Long Island City, N. Y. 12-page book presents new line of Certified pressure, vacuum and compound gages with photographs and diagrams. Also contains table of pressure equivalents.

21 CO_2 ANALYZER—Bacharach Industrial Instrument Co, 7000 Bennett St, Pittsburgh, Pa. Bulletin 338, 4 pages, describes application and use of Fyrite CO_2 analyzer with photographs, diagrams and charts.

22 TIME CONTROLS—Automatic Temperature Control Co, 34 East Logan St, Philadelphia, Pa. 8-page catalog B10 lists application, construction, types and operating features of series 2800 timers. Booklet also includes wiring diagrams, tables, electrical data, case drawings and illustrations.

MOTORS

23 STARTERS—Allen-Bradley Co, 1311 S First St, Milwaukee, Wis. 16-page catalog discusses factors that enter into selection of automatic reduced voltage starters for squirrel-cage motors. Bulletin also describes automatic resistance starters.

PIPING, VALVES AND FITTINGS

24 PIPE BENDER—Atlas Pipe Bender Corp, 141 E 25th St, New York, N. Y. 8-page leaflet describes the new fully-automatic Atlas pipe bender, series A, for general use wherever pipe must be bent economically. Photograph shows principles of operation.

25 STEAM TRAPS — Yarnall-Waring Co, Chestnut Hill, Philadelphia, Pa. 16-page bulletin T-1737 outlines Yarway impulse steam traps with operating principles, construction details, typical installations, additional applications, installation and operating suggestions, capacities and prices, weights and dimensions.

26 PIPE-JOINT COMPOUND — X-Pando Corp, 43-15 36th St, Long Island City, N. Y. Pocket-size circular, 6 pages, discusses X-Pando, pipe-joint compound that expands slightly after setting. Also lists typical users.

27 PIPE BENDING — Tal's Prestal Bender Inc, Milwaukee, Wis. 4-page booklet introduces Tal's Prestal, a portable hydraulic bending machine which is said to produce smooth, even bends on iron and steel bar and pipe in one simple operation. Photographs show machine parts and method of use.

28 VALVES—Fairbanks Co, 397 Lafayette St, New York, N. Y. 6-page folder describes Faircoseal bronze valves having threadless portways with preinserted rings of silver brazing alloy.

(Continued on page 174)

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(Sec.510,P.L.&R.)
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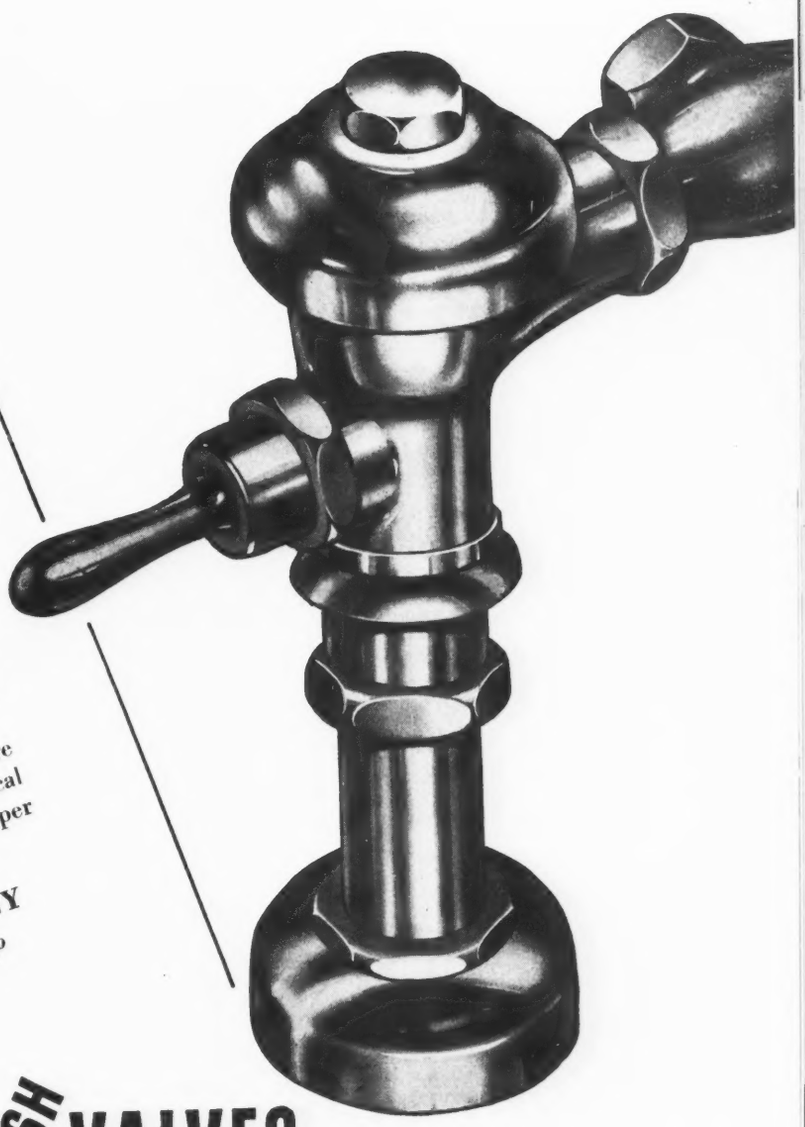
THEY RARELY NEED ATTENTION...BUT THEY DESERVE IT NOW!



● The average camera rarely needs attention—first. because it is built to stand a lot of abuse—and. second. because its functional design has been scientifically reduced to the simplest form.

The success of Sloan Flush Valves is largely due to these same reasons. But this is no time to take your camera or your Sloan Flush Valves for granted. Both are mechanical instruments and therefore both are subject to wear.

We urge you to call in a master plumber today and have him check every one of your Sloan Flush Valves. Probably many of them will need no attention whatever. Probably only a few repairs will be required. But remember, a single part for replacement is a lot easier to get than an entire new Flush Valve. You need to have the assurance that your every Sloan Flush Valve is working perfectly, still as good as new and ready for many more years of trouble-free service.

All the material used in the manufacture of your Sloan Flush Valves is on the critical list. Conserve vital metals by proper maintenance.

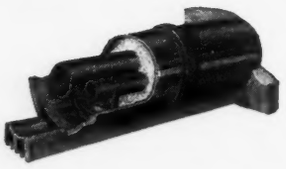
SLOAN VALVE COMPANY
4300 West Lake Street, Chicago

SLOAN FLUSH VALVES

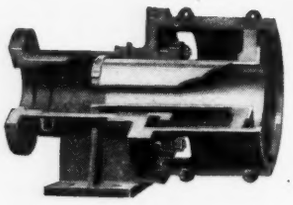
HOW TO KEEP VITAL STEAM LINES AT TOP EFFICIENCY FOR THE DURATION

And for Years Afterward

4 VALUABLE ADSCO SUGGESTIONS



1 For underground lines use sectional ADSCO-Bannon Tile Conduit with base drain. Insulated with ADSCO Filler Insulation, a "Fiberglas" product, it provides a permanent installation at low first cost and high thermal efficiency.



2 Determine expansion and contraction of the pipe line carefully, allowing an ample factor of safety. Use ADSCO Piston-Ring Expansion Joints. They can be unpacked and repacked under full operating pressure without interruption to service.

3 Install pipe alignment guides and pipe anchors made by ADSCO. They are essential to avoid undue strain on fittings and expansion joints; good assurance against future line failure.

4 Know your actual steam consumption for heating or process purposes. Install Condensation or Steam Flow Meters. ADSCO can furnish either kind to help you detect steam losses and improve utilization.

● ALL OF THE ADSCO PRODUCTS MENTIONED ABOVE ARE DESCRIBED IN THE ADSCO CATALOG NO. 35PR, copy upon request.

AMERICAN DISTRICT STEAM COMPANY NORTH TONAWANDA N. Y.

ADSCO HAS BEEN BUILDING "UP-TO-DATE" STEAM LINE EQUIPMENT *for over 60 years*

New Bulletins

(*Continued from page* 172)

29 VALVES — R-S Products Corp, Wayne Junction, Philadelphia, Pa. 4-page catalog No. 15-B describes precision-machined and wedge-tight cast-steel valves in 150-, 300-, and 600-lb sizes, with photographs, diagrams and tables of dimensions.

30 FLUSH VALVES—Imperial Brass Mfg Co, 1200 West Harrison St, Chicago, Ill. 16-page bulletin contains complete operating, adjusting and repair instructions for flush valves with drawings and cross-sectional views showing construction. Tells how to keep maintenance low, gives service data and lists parts.

31 SWIVELS — Trabon Engrg Corp, Cleveland, Ohio. Engineering bulletin No. 424 describes straight and angle swivels for making oil, grease, air and other line connections between stationary or oscillating surfaces, with photographs, diagrams and dimension tables.

32 STRAINERS — Yarnall-Waring Co, Chestnut Hill, Philadelphia, Pa. 4-page bulletin S-200 lists three improved features of Yarway fine-screen strainer, (1) inside and outside plating for protection against rusting, (2) special Monel woven wire screen, and (3) straight thread and machined face on blow-off bushing for easy removal and replacement of screen and for tight joint.

All literature designated with a star (★) may be obtained only by writing directly to the manufacturer on company letterhead, giving writer's name and title.

★ POWER PLANT EQUIPMENT—Williams Gauge Co, 2055 Pennsylvania Ave, Pittsburgh, Pa. 24-page catalog No. 142 contains technical data on such Williams specialties as pump valves, water gages, steam-pump governors, gage cocks, ball-type high-pressure steam traps, high- and low-alarm columns, etc.

PRIME MOVERS

33 POWER UNIT—K R Wilson, 10 Lock St, Buffalo, N. Y. 6-page folder outlines features of heavy-duty KRW industrial unit, built around Ford V-8 engine with photographs of unit and typical applications. Unit operates on natural gas or gasoline.

34 DIESELS—Hill Diesel Engine Co, Lansing, Mich. Specification sheets, 9, cover company's line of diesel-generator sets, engines and power units in three sizes, 2, 4 and 6 cylinders. Also show photograph and dimensional diagram of each type described.

PUMPS

35 PUMPS—Chain Belt Co, Milwaukee, Wis. 24-page bulletin No. 404 features Rex Pumpcrete, that pumps concrete, with complete specifications and dimensions for all size machines. Booklet also tells how to operate and set up Pumpcrete system.

36 PUMPS—Blackmer Pump Co, Grand Rapids, Mich. 24-page general catalog gives background of company's pump line and presents data concerning applications in petroleum, chemical, paint, food industries, in the marine field and in other industries. Also lists typical users.

37 PUMPS—Milton Roy Pumps, 1300 E Mermaid Ave, Philadelphia, Pa. Bulletin No. 426 explains how Step-Valve used in Milton Roy pumps is designed for specific purposes, and how it functions in pumping against pressures up to 20,000 lb psi. Illustrations show typical valve designs and why double-ball checks used in Step-Valve construction are claimed to be non-clogging and self-cleaning.

38 PUMPS—Viking Pump Co, Cedar Falls, Iowa. 20-page pocket-size service manual contains suggestions and

PACKINGS chart a course to Victory!

RECOMMENDATION CHART FOR THE USE OF BELMONT PACKINGS

APPLICATION	RECIPROCATING RODS AND PLUNGERS	CENTRIFUGAL AND ROTARY SHAFTS	GLOBE AND ANGLE VALVE STEMS	SHEET PACKINGS	GASKETS
	Style	Style	Style	Style	Style
STEAM High Pressure 340°F. and over	30 Asbestos Spiral Rubber Back 47 Asbestos Spiral Rubber Center 866 Semi-Metallic 745 Braided Asbestos Square 329 Asbestos Hollow Center	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 4010 Plastic (over 550°F.)	655 Braided Asbestos, Vulcanized 610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 4010 Plastic (550°F.) 2001 Shredded Metal (up to 550°F.)	590 Compressed Asbestos 591 Compressed Asbestos 595 Compressed Asbestos 603 Woven Asbestos W.I. 611 R. & B. Woven Asbestos W.I.	589 Compressed Asbestos 588 Compressed Asbestos 596 Compressed Asbestos 625 Woven Asbestos W.I. 629 R. & B. Woven Asbestos W.I.
STEAM Intermediate and Low Pressure under 340°F.	319 Hollow Center 1000 Cross Expansion 102 Extra Rubber and Duck 2 Expansion Channel 203 Combination Diagonal H.P. 204 Combination Diagonal 85 Combination Set, High Speed	745P Square Braided Asbestos 2056 Shredded Metal, Cotton Covered 4000 Plastic 2001 Shredded Metal	610 Braided Asbestos, Lubricated 740 Twisted Asbestos, Lubricated 4000 Plastic 2001 Shredded Metal	602 Black Sheet	642 Black Sheet

While these recommendations are based on years of experience, no guarantees are made in view of the many peculiarities that may center around one application as compared with another of similar nature. Consult with us for special or unusual services.

VICTORY is the target at which we're shooting, and though it's only nine months since the scrap began . . . production, the big gun of America, is now scoring bulls' eyes.

Spouting from the assembly lines throughout the Nation are the planes, guns, tanks, ships and other essentials so necessary to this all-out war effort. To keep these weapons pouring forth is the job that faces industrial America today.

Men are working longer, machines harder. Under this terrific strain wear in equipment is bound to be more prevalent. Extra precautions must be taken or vital parts are apt to go, losing time our most precious asset in this battle of mechanization.

Packings play their part in this gigantic production program. This advertisement is published as an industrial service to help save your time when a packing selection must be made. If the problem is steam, this chart will guide you in making the proper Belmont Packing selection to meet your requirements.

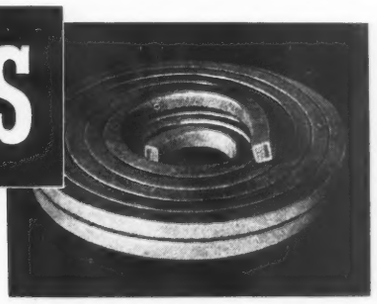
THERE'S A BELMONT PACKING FOR EVERY SERVICE . . . Steam, Water, Oil, Gas, Air, Acid, Alkalis, Ammonia. FORMS INCLUDE . . . Rings, Coils, Spirals, Reels, Spools, Sheets, Gaskets.

Belmont Packings are Sold by Authorized Belmont Distributors in Every Large Industrial Center

THE BELMONT PACKING & RUBBER CO. — BELMONT — PHILADELPHIA, U.S.A.

● For those desiring more detailed information the Belmont Catalog is available. This book contains 84 pages of packing information reduced to its simplest form. All types of Belmont Packings are illustrated and described. Packing end views are pictured in large size showing minute details. Constructions, applications, tables of weights, all are included. The Belmont Packing Catalog has been prepared by packing engineers. It's a book you should not be without. Write on your Company letterhead for your copy, today.

BELMONT PACKINGS



THE BELMONT PACKING & RUBBER COMPANY

DEPT. P-1042

BUTLER AND SEPVIVA STREETS • PHILADELPHIA, PENNSYLVANIA

FLEXPEDITE

Your Conversion Assembly Production

with

REX *Flexible* METAL HOSE

In REX Flexible Metal Hose you have an immediate solution for your re-design problems where compactness and flexibility are imperative. Plus this, you conserve materials because REX Flexible Continuous Lengths Metal Hose eliminates the need for long lengths of piping and pipe joints. It enables engineers to simplify designs—provides the means for solving fluid and gas handling problems—speeds manufacture by facilitating assembly. There are easily attached fittings for every requirement. REX Flexible Metal Hose withstands flexing and vibration and assures better product performance.

Utilize this range of adaptability—write for data and engineering recommendations on specific problems involving flexible connections.

REX-WELD Corrugated Flexible Metal Hose.
REX-TUBE Interlocked Flexible Metal Hose.
REX-FLEX Stainless Steel Flexible Tubing. AVIO-FLEX Oil Line Hose. CELLU-LINED Hydraulic Hose.

COPYRIGHT, 1942, CHICAGO METAL HOSE CORPORATION, MAYWOOD, ILLINOIS

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Ill.

instructions for pump maintenance. Parts are described and illustrated and hints are given on care of each section.

39 PUMPS — Worthington Pump & Mach Corp, Harrison, N. Y. Bulletin W-111-B31, 4 pages, features Worthington horizontal single-piston pumps. Also contains capacities, specifications and dimensions.

WATER TREATMENT

40 WATER SOFTENERS — Worthington Pump and Mach Corp, Harrison, N. J. 6-page folder, W-212-B2, describes and illustrates Worthington hot-process water softeners with cross-sectional diagram and photographs.

41 WATER TREATMENT — American Water Softener Co, Lehigh Ave & 4th St, Philadelphia, Pa. 12-page bulletin (No. 101-B) describes a number of different types of equipment which answer problems of corrective chemical feeding for water refining. Bulletin serves a guide for proper selection for individual applications.

WELDING

42 WELDING CHART—Lincoln Electric Co, Cleveland, Ohio, Wall chart, approx 17x23-in., illustrates weld characteristics for fillet welds and beads made with shielded arc electrode under various conditions.

43 WELDING — Cullen-Friestedt Co, Chicago, Ill. Bulletin WP 22, 16 pages, describes practice of welding on positioners and lists typical welding jobs with descriptions of position-welding methods.

OTHER EQUIPMENT

44 GLASS BRICK — Owens - Illinois Glass Co, Toledo, Ohio. 24-page handbook entitled, "Alternate Construction Details to Save Metal and Aid War Construction," tells how to install glass brick in new and old buildings without using critical materials.

45 PRECISION LATHES—South Bend Lathe Works, Dept 5P, South Bend, Indiana. Catalog No. 16, 8 pages, illustrates and describes 16-in. toolroom lathes and 16-in. quick-change gear lathes. Also lists attachments, accessories and tools for use with these lathes.

46 PRINT MAKING—Ozalid Products Div, Johnson City, N. Y. Booklet explains the Ozalid process of making dry-developed, positive-type whiteprints, offers suggestions about making prints, duplicate originals, corrections, etc, on whiteprint or dry-developing machines.

47 AIRCRAFT PRODUCTION — General Electric Co, Schenectady, N. Y. GEA-3395, 42-page booklet, contains almost 200 photos of applications and products illustrating wide range of precision-built equipment for aircraft industry. Describes load-center power distribution systems, motors and controls for many uses, resistance-welding controls, arc-welding equipment, and such equipment for the plane as instruments, voltage regulators, motors, relays, generators, etc.

48 SAFETY PRODUCTS — Davis & Murphy, Davis Bldg, Chicago, Ill. 4-page folder covers company's line of safety products including the GW cleaning and degreasing tool, liquid skin guard, electric lanterns, pumpless gasoline blow torch, eye and face shields.

49 RUBBER—B F Goodrich Co, Akron, Ohio. 30-page guidebook lists application and properties of many products for industrial and aeronautical purposes using natural, synthetic or reclaimed rubber. Among eleven indexed sections are: properties of Ameripol, hydraulic equipment parts, extruded rubber goods, and properties of reclaimed rubber.

50 VISE—Studebaker Machine Co, 9 South Clinton St, Chicago, Ill. 4-page folder introduces Drilvise, an automatic hydraulic vise for drill press work and other operations, with photographs, diagrams and specification table.

51 SAFETY—Whiting Corp, 157th St and Lathrop Ave, Harvey, Ill. Manual contains rules for guidance of

INGERSOLL-RAND COMPRESSORS

STEAM DRIVE

Large two-stage gas compressor with the steam-end built into the same machine.

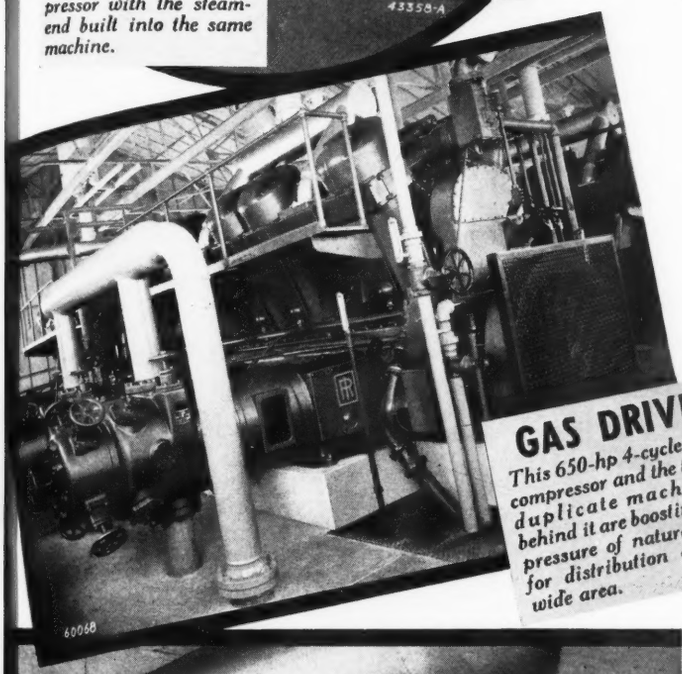
FOR GAS DISTRIBUTION

For more than 50 years Ingersoll-Rand Compressors have been the standard of comparison in the Gas Industry.

Today, these modern heavy-duty compressors are built in types which incorporate all kinds of prime movers . . . electric motors, V-angle gas engines, and steam engines to suit any steam conditions.

Compressor cylinders are available for either high- or low-pressure distribution systems . . . and regulating devices can be furnished to meet the special services encountered in the gas industry.

Let our representative help in your planning and in the selection of equipment you need.



GAS DRIVE

This 650-hp 4-cycle gas compressor and the three duplicate machines behind it are boosting the pressure of natural gas for distribution over a wide area.

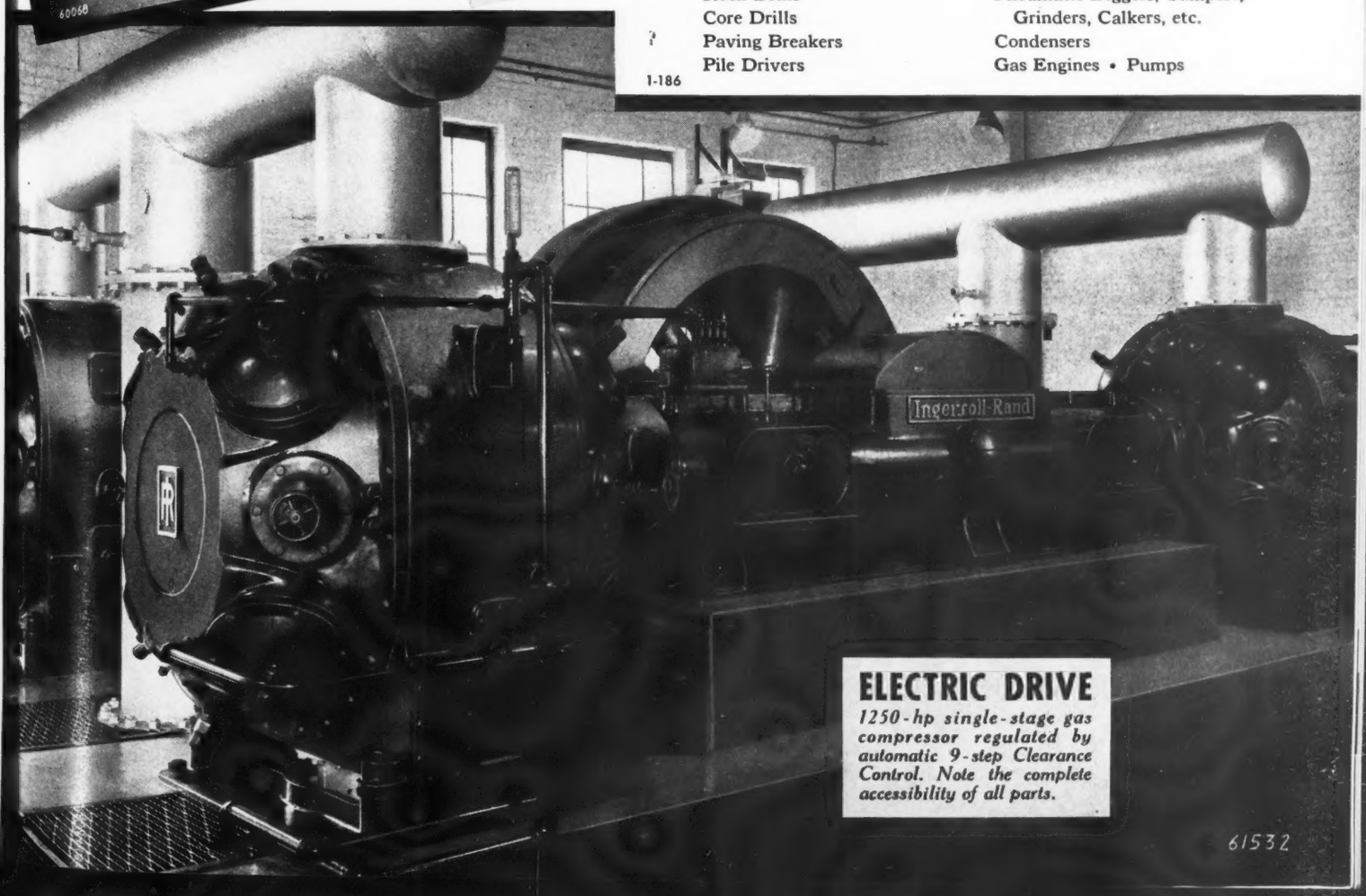
Ingersoll-Rand

11 BROADWAY, NEW YORK, N. Y.

OTHER I-R PRODUCTS FOR UTILITIES

Portable Compressors	Air Hoists
Rock Drills	Pneumatic Diggers, Tampers, Grinders, Calkers, etc.
Core Drills	Condensers
Paving Breakers	Gas Engines • Pumps
Pile Drivers	

1-186



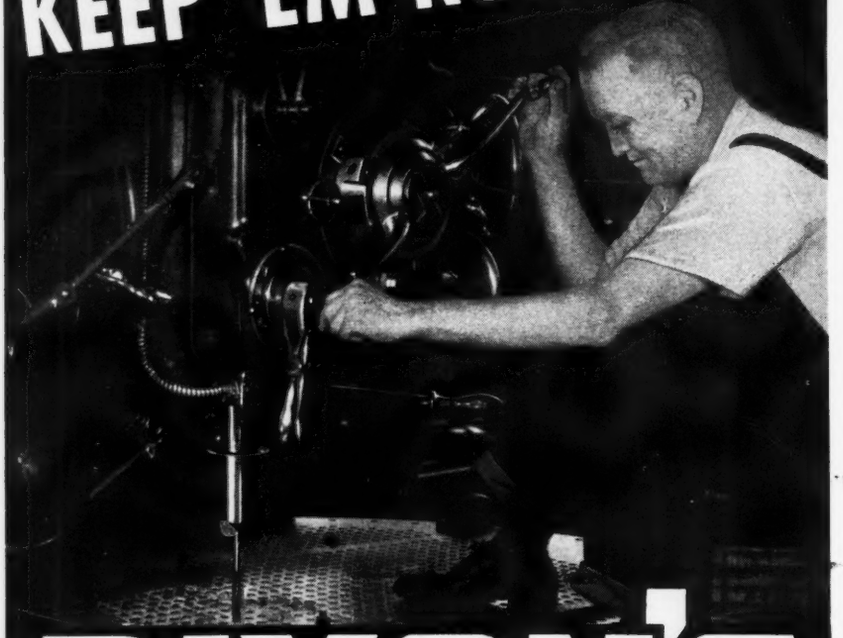
ELECTRIC DRIVE

1250-hp single-stage gas compressor regulated by automatic 9-step Clearance Control. Note the complete accessibility of all parts.

61532

Lost hours are lost production!

KEEP 'EM RUNNING!



DIXON'S GRAPHITE PRODUCTS

War-condition your equipment to stand emergency speeds, pressures, hours. DIXON'S Graphited lubricants s-t-r-e-t-c-h bearing life, reduce friction load, increase capacity, speed output.

DIXON'S TICONDEROGA
Flake Lubricating Graphite — For cylinders, bearings, packings, gaskets, threaded joints. Choice of large and small particle sizes.

DIXON'S NO. 635
Similar to Ticonderoga but processed to reduced particle size for closer tolerances.

DIXON'S MICROFYNE
Extra finely subdivided particles for closest fits.

DIXON'S CUP & PRESSURE GUN GRAPHITED GREASE
Ideal for indoor and outdoor equipment. Available in six consistencies.

Write for booklet 94, "Graphite Products for General Industrial Uses"

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY, N. J.

Ticonderoga Graphite • No. 635 Graphite • Microfyne Graphite • Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite).

2002

crane operators and hookers-on and for men working in the crane-operating area and the standard set of crane signals which have been adopted almost universally.

52 RESURFACING COMPOUND—Central Paint & Varnish Works, 63-69 Prospect St, Brooklyn, N. Y. Leaflet describes Lev-L-Flor, a synthetic product with a resilent finish that can be used on wood, concrete and other surfaces. Product is ready mixed and ready for use in repairing, resurfacing, water-proofing, and patching.

53 SOLDERING IRONS — Hexacon Electric Co, 161 W Clay Ave, Roselle Park, N. J. New circular describes Hexacon line of electric soldering irons, both screw and plug tip with illustrations of each.

54 WATER TREATMENT — Oakite Products Inc, 22 Thames St, New York, N. Y. 24-page manual reviews methods for removing carbonizing oil, sludge, lime-scale and rust deposits from many different types of water-cooled or water-circulating equipment to maintain heat-transfer efficiency, with special emphasis on Oakite Compound No. 32.

55 HYDRAULIC OILS—E F Houghton & Co, 303 West Lehigh Ave, Philadelphia, Pa. 12-page booklet outlines the necessary qualities of a hydraulic oil and describes company's Hydro-Drive "MIH" series with improved oxidation stability.

New Power Construction

Construction to Come

Alabama—U. S. Eng, 494 Spring St, N W, Atlanta, Ga., plans constructing plant. Over $3,000,000.

Arizona—Bids Sept 14, by Bureau Reclamation, Customhouse, Denver, Colo., for turbine-inlet pipe for unit N-7, Boulder power plant, Boulder Canyon project, Spec 1665-D.

California—Federal Works Agency, 1206 Santee St, Los Angeles, plans constructing pump plant. W L Felt, 1296 Santee St, Los Angeles, engr.

Indiana—Perfect Circle Co, Hagarstown, plans constructing plant addn. $3,000,000-$5,000,000. Federally financed.

Indiana—U. S. Eng, 520 Merchandise Mart, Chicago, Ill., plans constructing mfg plant. Over $5,000,000.

Indiana—U. S. Eng, Federal Bldg, Louisville, Ky., plans plant conversion. $1,000,000-$5,000,000.

Ind., Dresser—Bids Sept 8, by Sargent & Lundy, engrs, 140 S Dearborn St, Chicago, Ill., constructing superstructure generator station for Pub Service Co of Indiana, Traction Bldg, Indianapolis, $150,000.

Iowa—U. S. Eng, 1709 Jackson St, Omaha, Neb., plans expanding mfg plant, Polk Co, exceeds $2,000,000.

Kansas—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., plans constructing plant. Over $3,000,000. Arthur G McKee Co, 2300 Chester St, Cleveland, O., engrs.

Kansas—U. S. Eng, E 17 St, Kansas City, Mo., plans constructing improvements. $3,000,000-$5,000,000.

Louisiana—Aluminum Co of America, North Baton Rouge, plans constructing plant addn. $8,500,000. Federally financed.

Louisiana—Texas Co, 919 St Charles St, New Orleans, Humble Oil & Refining Co, Humble Bldg, Houston, Tex., Tide

Whether it's gun-barrels or boiler tubes—This is the time to

KEEP 'EM CLEAN!

Fouled gun barrels cause inaccurate shooting and wasted shells. Fouled boiler tubes cut down boiler efficiency and waste fuel. America today has no place for either.

Your boilers may be of the latest high-pressure type with tubes everywhere, including long tubes with many bends. Or your boilers may be 20 years old. You *always* need tube cleaner equipment either for regular service or as insurance against scale accumulation.

Put the job of boiler tube cleaning up to Elliott-Lagonda equipment. We have motors to fit the tubes, go around the bends and make a quick job of cleaning. We have a selection of cutter heads, drills, brushes to match any tube cleaning need whether it be ½" tubes or 20" pipes.

ELLIOTT COMPANY

LAGONDA-LIBERTY Tube Cleaning Dept.

SPRINGFIELD, OHIO

DISTRICT OFFICES IN PRINCIPAL CITIES

Y-184

ELLIOTT-LAGONDA TUBE CLEANERS

Wheelco is still

FIRST

. . . in pioneering new applications for engineered electronics in temperature control. The famous "Electronic Principle" Control System provides faster, more accurate control than any other type of control and is constantly being applied to more control problems. In 1941, Wheelco incorporated the instantaneous control action of the "Electronic Principle" and extreme accuracy of temperature measurement into the UNIVERSAL Temperature Controllers, which are the first to provide such plus values as interchangeability of all component parts, interchangeability of scale ranges, ready accessibility of all parts for individual checking and many other features. UNIVERSAL Controllers include Capacitrols, Potentio-trols, Limitrols and Resistance Therm-otrols.

Wheelco continues to pioneer new control applications for the "Electronic Principle"

Write for FREE Bulletin No. Z6000.

1935

"Electronic Principle" Temperature Control was introduced—since proved superior to all other types of controllers. *(D2). "Limitrols" *(D202) and initial line of Indicating Pyrometers *(D302) was introduced.

1936

"Flame-otrol" announced — only combustion safeguard for all fuels approved by both Underwriters' Laboratories and Factory Mutual Laboratories *(12). Portable Indicating Pyrometers also added *(D602).

1937

"Proportioning Control", means of continuously varying fuel input to maintain constant temperature—applied to "Electronic Principle" Controllers *(D2). Portable Potentiometers *(A502), Heat-eyes *(S2) and Time Delay Relays *(S302) added.

1938

"Potentio-trol", potentiometric method of temperature measurement combined with "Electronic Principle" Control *(A2) introduced. "Program Control" *(D2), "Rheo-trols" *(J302), "Flame-eyes" *(L302) and Automatic Ignition "Flame-otrols" *(12) announced.

1939

. . . added "Electronic Principle" Thermometer Controllers *(G502) to the Wheelco Line, for low temperature applications. Indicating *(G302) and Recording *(G403) Thermometers were introduced.

1940

The "Therm-otrol", Recording Control Thermometer *(G503) was announced. Available in any type of measuring and control system for ranges from —50°F. to 1000°F.

**(No.) indicates Bulletin No. describing instrument. Write for them.*

Wheelco Instruments Co.

863 W. HARRISON STREET • • • CHICAGO, ILLINOIS

Water Asso Oil Co, and Phillips Petroleum Co, both Esperson Bldg, Houston, Tex., plan constructing plant. $2,000,000. Federally financed.

Mass., Hingham—Bethleham-Hingham Shipyard, Inc, E Howard St, Quincy, soon lets contract constructing brick, boiler compressor house.

Mass., Lynn—General Electric Co, 920 Western Ave, soon lets contract constructing brick, concrete boiler plant, $40,000.

Minnesota—U. S. Eng, U. S. Post Office & Customhouse, St. Paul, plans expanding mfg plant, Ramsey Co, exceeds $4,000,000.

Minn., St. Paul—Northern States Power Co, 15 S 5 St, Minneapolis, G O House, mgr, 3 and Wabasha St, St. Paul, preparing plans constructing superstructure power plant at High Bridge, Mississippi River. Est complete projects $5,000,000.

Nebraska—U. S. Eng, 1709 Jackson St, Omaha, plans constructing plant enlargement. $5,000,000.

New Jersey—Industrial company plans by William Neumann & Sons, 487 Summit Ave, Jersey City, plans altering and constructing plant, $1,500,000. Navy Dept will finance.

New York—U. S. Eng, 960 Ellicott Square Bldg, Buffalo, plans expanding mfg plant. Over $2,000,000.

New York—U. S. Eng, 120 Wall St, New York, plans constructing imprvs. Over $3,000,000. A D Crosett, 512 5 Ave, New York, engr and archt.

Ohio—National Carbon Co, Inc, 30 E 42 St, New York, N. Y., plans constructing plant. $2,500,000-$3,000,000. Defense Plant Corp will finance.

Ohio, Hamilton—City, R P Price, mfr, bids soon for new equip for electric power plant, switchgear, $47,000; substations $43,450; transformers $24,750; circuit breakers $17,400; control equip $7,170. Froelich & Emery Eng Co, Toledo Trust Bldg, Toledo, engrs.

Pennsylvania—U. S. Eng, 925 New Federal Bldg, Pittsburgh, plans expanding mfg plant. Over $3,000,000.

Pennsylvania—U. S. Eng, Chimes Bldg, Syracuse, N. Y., plans expanding plant. Over $3,000,000.

Pennsylvania—J H Williams & Co, 400 Vulcan St, Buffalo, N. Y., plans constructing plant. Defense Plant Corp will finance.

Texas—Dow Chemical Co, Freeport, plans constructing plant, $18,000,000. Federally financed.

Texas—Reconstruction Finance Corp, 311 Vermont Ave N W, Wash., D. C., plans constructing plant. $3,000,000.

Texas—U. S. Eng, 231 W Main St, Denison, plans made constructing addnl power house for Denison Dam Project, Red River, $2,000,000.

Texas—U. S. Eng, 231 W Main St, Denison, plans expanding mfg plant. Over $2,000,000.

West Virginia—U. S. Eng, Chesapeake & Ohio Bldg, Huntington, W. Va., plans constructing mfg plant, Wetzel Co, exceeds $3,000,000.

Contracts Let

Alabama—U. S. Eng, 306 Courthouse, Nashville, Tenn., awarded contract constructing water treatment and pump

Bartlett-Snow
WEIGH LARRIES
—make it possible to keep an accurate record of the coal being fed to each boiler—prevent the segregation of coal—and permit an entire row of boilers to be supplied from a single bunker located at the end or entirely outside the building, resulting in substantial savings in building and bunker costs. Hand propelled and motor driven types in capacities from ½ ton to 20 tons per single trip. Eng. Bul. No. 83 sent on request, gives full details. The C. O. Bartlett & Snow Co., 6205 Harvard Avenue, Cleveland, Ohio.

TIME IS UP....

but not for the average

WARREN PUMP

many of which go on indefinitely after their "life expectancy" span. The reason: Warren never compromises with sound engineering principles, cheapens at the expense of reliability, barters safety for price advantage or recommends along the border line.

These brief case histories are typical of Warren Pump longevity:

June 15, 1901 **. . . A Warren Horizontal Duplex still doing duty with a Coast Guard Unit.**

November 28, 1899 **. . . A Warren Horizontal Duplex Pump originally sold a municipality but of late years in service at a rendering company.**

October 2, 1899 **. . . A Warren Duplex Pump still on duty at a Connecticut brass works.**

1901 and 1911 **. . . Two Warren Hydraulic Pumps still on the job at a Pennsylvania cork products manufacturer.**

1924 **. . . Two Warren steam-driven vacuum pumps on duty for past eighteen years, 24 hours a day, 365 days a year.**

Warren also manufacturers a complete line of Centrifugal Pumps. *Whatever* type of Warren Pumps you select, you can be sure of getting dependability and long life.

WARREN PUMPS

Warren Steam Pump Co., Inc. **Warren, Mass.**

plant, Lawrence Co, to C F Hooks, 520 S W 15 St, Birmingham. $50,000-$100,000.

Arizona—U. S. Eng, 751 S Figueroa St, Los Angeles, Calif., awarded contract relocating electrical substation, Pima Co, to Tucson Gas Electric Light and Power Co, Tucson. Under $50,000.

Ark., Lake Catharine—Louisiana Electric Cooperative, Fort Smith, awarded contract constructing substation, to L O Brayton, Dyersburg, Tenn. Est $50,000.

Colorado—U. S. Eng, c/o Post Office, Denver, awarded contract constructing addn and alteration to power house, to N R Nielsen, Denver. $40,000-$100,000.

Connecticut — Industrial company awarded contract constructing boiler plant, to J Winkel Co, Inc, 148 Larchmont Ave, Larchmont, N. Y. $105,000.

Florida—U. S. Eng, Courthouse & Customhouse, Mobile, Ala., awarded contract constructing laundry steam plant, to The Jordan Co, Columbus, Ga.

Georgia—U. S. Eng, 494 Spring St N W, Atlanta, awarded contract for turbogenerator unit, Cobb Co, to General Electric Co, Red Rock Bldg, Atlanta. $50,000-$100,000.

Georgia—U. S. Eng, Bellcraft, awarded contract constructing superstructure for plant, to McDougald Const Co, Hemphill Ave N W, Atlanta. Industrial Company will operate. Total cost $30,000,000.

La., New Orleans—New Orleans Pub Service, Inc, 317 Baronne St, awarded contract constructing power house addns, alterations, to Boh Bros Constr Co, 2400 Cypress St. Est. $189,000.

Maryland—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., awarded contract installing boilers and accessories, to D D Condon Co, 1318 9 St N W, Washington, D. C., $25,469.

Mass., Hudson—Town, Electric Light & Power Dept, Town Hall, awarded contract constructing power plant addn, to G Bonazzoli & Sons, Washington St. Est. $40,000.

Missouri—U. S. Eng, 800 Courthouse & Customhouse, St. Louis, awarded constructing cold-storage house and addn, warehouse, to Vernon Higbee Constr Co, 6504 Nashville Ave, St. Louis.

Missouri—U. S. Eng, P O Box 97, Memphis, Tenn., awarded contract constructing imprvs, deep wells, pumps, gasoline engine and electric motor drives, pump houses, No 1092-42-24F, to C M Journey, Highway 61, Memphis, Tenn. Est less than $1,000,000.

New York—Industrial company awarded contract constructing manufacturing plant, to Foley Bros, Inc, Vermilyea St, Pleasantville. $5,000,000. Francisco & Jacobus, 511 5 Ave, New York, engrs. Federally financed.

New York—U. S. Eng, Chimes Bldg, Syracuse, awarded contract constructing power plant, Albany Co, to T C Brown, Schenectady. $100,000-$500,000.

North Carolina—U. S. Eng, 308 Customhouse, Wilmington, awarded contract constructing concrete water storage tank and hydro-pneumatic pump, station, Durham Co, to William Muirhead Constr Co, Durham, under $50,000.

Ohio, Cleveland—Harris-Seybold & Potter Co, c/o A S Harris, 4500 E 71 St, awarded contract constructing boiler house, radial brick stack, to Gillmore-Carmichael-Olson Co, 1873 E 55 St. Est. $40,000.

Ohio—U. S. Eng, 700 Union Guardian Bldg, Detroit, Mich., awarded contract constructing power distribution and mas-

No repairs, practically no wear in 25,000 hours of operation!

— another example of better lubrication with Gulf Quality Lubricants

Actual photo of a Gulf engineer *(left)* consulting with chief engineer on Diesel engine lubrication.

"The maintenance record of this Diesel has been remarkable with Gulf lubricating oil in service," *says this chief engineer.* **"The tool marks are still visible on the lower compression rings, and cylinder wear totals only .005 inches after five years of operation."**

THE 5-year maintenance record of this Diesel unit with Gulf lubricating oil in service is hard to beat. Over 25,000 hours of operation during this period, yet no valve replacements or other repairs necessary, and cylinder wear totals *only .005 inches!* Here is additional evidence of the *higher protection value* of Gulf quality Diesel lubricating oils.

There are good reasons for the exceptional performance of these superior Diesel lubricants! They are manufactured from selected crude oils by the most modern refining methods. And built into these lubricants are stability and stamina—they stand up and provide a tough long-lasting film which affords maximum protection to cylinders, bearings and pistons. Result: minimum wear, minimum down time, and efficient, dependable Diesel performance under the peak load operating conditions of today.

If you have any reason to feel that the operating or maintenance records of *your* units could be improved, ask a Gulf engineer to call. His broad experience with many types of Diesels is your assurance of sound suggestions which will help you get more efficient performance and lower operating costs.

The services of a Gulf engineer—and the Gulf line of quality Diesel lubricating oils—are quickly available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

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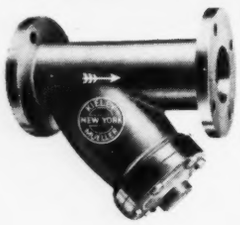
OIL IS AMMUNITION — USE IT WISELY!

K & M STRAINERS are built by Specialists since 1879

We're "ALL OUT" so the AXIS will be "ALL IN" Please bear with us for the duration

Back of K&M Strainers as well as all K&M steam specialties is an organization of engineers with an accumulated experience going back more than 63 years. An extensive line has been developed by Kieley & Mueller to cover power and process service requirements. Typical strainers in the K&M line are shown here.

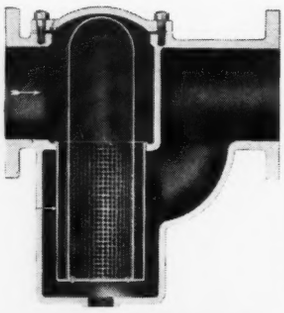


"Y" STRAINERS

Designed for use on steam, water, air, gas, oil and other fluids K&M "Y" Strainers provide an efficient means of extracting foreign matter. Large strainer basket area assures minmum pressure loss. Baskets easily accessible for cleaning. Sizes: ½" to 6".

BASKET OR SUCTION STRAINERS

Designed and built for removing and preventing foreign matter from entering lines leading to vacuum pumps, feed pumps, water works lines, etc. May be used on water, oil, gas, steam or other fluids. Large free area strainer basket allows minimum pressure drop. Basket easily removed for cleaning. Sizes: ½" to 18".



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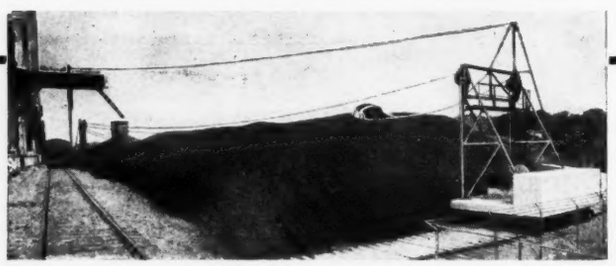
Reducing Valves — Liquid Level Controls — Float Valves — Pump Governors — Strainers — Control Specialties.

Coal Storage Simplified

with an economical SAUERMAN SCRAPER



ENGINEERS and superintendents of power plants large and small where coal is being stored and reclaimed with SAUERMAN Power Scrapers say that this equipment is giving them a maximum of satisfaction.

These machines operate rapidly and economically—handling coal into and out of storage in any required capacities. Coal is piled layer on layer (to 40 ft. heights) and the constant movement of the scraper across the pile packs the coal tightly so that there are no air pockets, hence no chance for spontaneous combustion. To change the operation from storing to reclaiming takes only a few minutes. The operator is housed in a comfortable control station where he has a view of the entire storage area. The operation is completely automatic.

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SAUERMAN BROS., Inc.
562 S. Clinton St., Chicago

SAUERMAN

POWER SCRAPERS **FOR STOCKPILING**

ter substation, Allen Co, to R C Martin Co, Detroit, Mich. Less than $1,000,000.

Ohio—U. S. Eng, 700 Union Guardian Bldg, Detroit, Mich., awarded contract constructing boiler house, Allen Co, to Albert M Higley Co, 2036 E 22 St, Cleveland, less than $1,000,000.

Oklahoma—Continental Oil Co, Ponca City, will construct 2 plants, one $2,400,000, other $2,600,000 by force account. Defense Plant Corp will finance.

Pa., Franklin—Keystone Pub Service Co, Oil City, awarded contract constructing addns, alterations power plant, 13 and New Sts, own forces. Over $40,000.

South Carolina—U. S. Eng, 32 Customhouse, Charleston, awarded contract constructing switching station, electrical distr lines, Richland Co, to Seastrunk Electric Co, 1731 Harden St, Columbia, under $50,000.

South Dakota—U. S. Eng, 1709 Jackson St, Omaha, Neb., awarded contract constructing temporary frame bldgs, steam plant, Minnehaha Co, to Syndicate Contractors, Sioux Falls. $100,000-$500,000.

Tennessee—U. S. Eng, P O Box 97, Memphis, awarded contract constructing electrical dist sys primary switch station, Shelby Co, to Shelby Electric Co, Inc, 112 E Iowa Ave, Memphis, under $50,000.

Washington—U. S. Eng, 800 3 Ave, Seattle, Wash., awarded contract constructing standby power plant, Pierce Co, to J F Graham, Tacoma, $50,000-$100,000.

Wisconsin—U. S. Eng, 408 Federal Bldg, Milwaukee, awarded contract constructing steam generating, steam dist and condensate return sys, Dane Co, to Power Service Corp, 510 W Juneau Ave, Minneapolis, Minn., $100,000-$500,000.

Engineers' Books

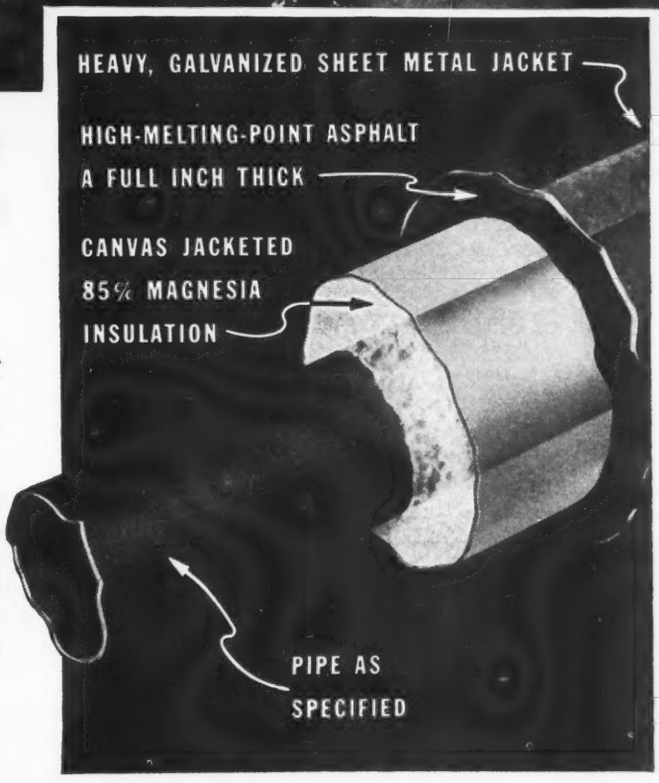
(*Continued from page* 132)

cover inspection and testing of welds, specimen preparation and even mechanical drawing of welded parts to aid the welder in reading blueprints particular to welding.

Fundamental techniques of oxyacetylene and arc welding have not been neglected and the treatment is entirely practical. Of special interest to the power-plant operator are specific instructions on building up shafts by welding and the proper methods of repairing broken or cracked parts. A slight British flavor does the book no harm.

WELDING—*By James A Moyer. Published by McGraw-Hill Book Co, Inc. 330 W 42nd St, New York, N. Y. 185 pages, cloth bound, 97 illustrations, various tables, price $2.25.*

The field of welding is developing and expanding rapidly and the need for welders is increasing as our war expansion program progresses. The object of this book is to describe in a



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TENS of thousands of feet of Durant Insulated Pipe with a record of years of service have proved the ability of this system to stand up under the severest conditions.

The reason lies in its construction. In Ehret's D.I.P. there is combined the time-defying characteristics of asphalt and the high insulating efficiency of 85% Magnesia. Factory pre-fabrication makes field installation rapid and economical. The result is an underground piping system that is outstanding, both in efficiency and long life.

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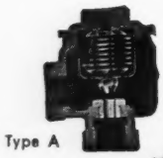

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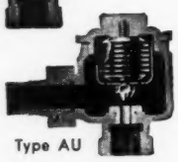

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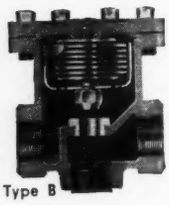

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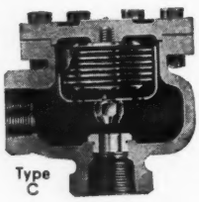

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SEE OUR CATALOG IN SWEET'S

HERE is a trap that completely drains itself. It is non-freezing and non-airbinding, requires no adjustment. Ideal for outside installations or in buildings where steam is off at times during the winter.

Nicholson Traps are available in Bronze, Cast Iron and Cast Steel construction in sizes ¼ to 2 in. Good for pressures up to 300 lb. Specify Nicholsons for improved drainage of Unit Heaters, Pipe Coils, Water Heaters, etc.

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FULLY ACTIVE GRATE SURFACE. More grate area with low combustion rate per square foot! . . . Frederick Stokers has specially designed tuyeres with air ports arranged and proportioned to improve air distribution and insure maximum efficiency in combustion.

TUYERES ARE LOCKED IN PLACE—can't be removed without removing the locking rod—can't be raked up inadvertently.

WIND BOX IS COMPLETELY ENCLOSED. Simplifies and makes a neater installation; eliminates danger of efficiency loss through leaking brickwork.

DOUBLE CLEAN-OUT — gives easy access to *both* sides of the undergrate area. Permits thorough cleaning, faster.

Illustration shows bin feed model stoker

50% OVERSIZE MOTORS—PROPORTIONED AIR SYSTEM—IMPROVED HEAVY DUTY TRANSMISSION—*Ask about all these; just write—*

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COMPLETE LINE OF CENTRIFUGAL PUMPS FOR ALL PURPOSES
STEAM OPERATED ASH CONVEYING SYSTEMS - ASH STORAGE BINS

general way the various modern methods of welding metals, particularly iron and steel. The manuscript was prepared with the help of specialists in both the practical and theoretical fields of modern gas and electric welding.

Early chapters discuss the gas used for welding, welding torches, their types and construction as well as the purpose of each; pressure gages and regulators with directions for their care, and a complete study of the characteristics of the gas flame for welding and burning. The technique of oxyacetylene welding and cutting is explained in considerable detail.

Arc welding covers such subjects as arc characteristics, description of various machines used for current supply, bare and coated electrodes and the purpose of each, deposition of metal, and how to manipulate the electrode during welding. Many different kinds of joints, showing the correct method of welding each, are described.

The section devoted to metallurgy and testing describes methods used for quenching and stress relieving, X-ray testing, qualification and other simplified tests. The weldability of metals includes a study of the alloy steels, cast iron, nickel steel, aluminum, and monel metal as well as the more commonly used metals.

Resistance, condenser-discharge, spot, atomic-hydrogen arc, and thermit welding are described; the condenser-discharge being a method more recently developed to avoid the large intermittent currents that occur in ordinary resistance welding.

Other sections of the book are devoted to welding cost and safety equipment. Charts and tables showing melting points of metals, identifying metals from spark tests and fractures, physical properties of welds, etc. are included along with the text. Troubleshooting for arc welding and welding parts made by powder metallurgy are contained in the appendix.

WELDING HANDBOOK (second edition 1942) *prepared under the auspices of the American Welding Society (D S Jacobus, committee chairman and W Spraragen, editor). Published by the American Welding Society, 33 West 29th St, New York, N. Y. Represents work of 270 leading welding experts. 6 x 9 in., cloth, 1593 pages, profusely illustrated. Price $6.00 U. S. A., $6.50 elsewhere.*

Interest in welding is widespread, intense and growing. This new edition fills a need and will have a good reception. The volume covers, first, the

For Severe Conditions

PERMANENTLY INSULATED ROCKBESTOS

One hundred and twenty-two different standard types of *permanently insulated* wire have been developed by Rockbestos—all designed to give better and longer service *under severe operating conditions* in specific applications. They are built to *permanently resist* such wire-destroying hazards as heat and moisture, oil, grease, corrosive fumes and fire. This page shows a few that are widely used in industry. For further information send for our catalog.

RESISTS
Heat—Fire
Corrosive Fumes
Oil—Grease
Moisture

600 VOLT A.V.C. SWITCHBOARD WIRE—TABLE B

(Underwriters' Type AVB)

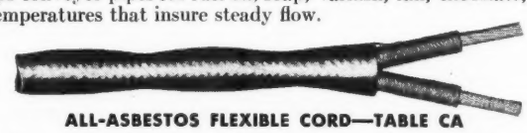
Sizes No. 18 to 4/0 A. W. G. with varnished cambric and felted asbestos insulation and gray, black, white or colored flameproof cotton braid.

Combine fire insurance and fine appearance in your switchboards with Rockbestos Switchboard Wire. It is absolutely fireproof and will not dry out under heat. Sharp, clean bends can be made without cracking as the asbestos wall acts as a cushion under the braid. Rockbestos A. V. C. Hinge Cable and Switchboard Bus Cable have the same fireproof and heatproof characteristics.

INDUSTRIAL HEATING CABLE—TABLE LH

No. 19 A. W. G. nickel-chromium wire insulated with .040" of felted asbestos and covered with 4/64" waterproof lead sheath.

This pliable cable distributes a mild heat evenly over a large area. Prevents freezing of water pipes, wet pipe sprinkler systems, etc. Keeps conveyor pipes for fuel oil, soap, varnish, ink, chocolate, etc., at temperatures that insure steady flow.



ALL-ASBESTOS FLEXIBLE CORD—TABLE CA

Sizes No. 10 to 18 A.W.G. with two or three conductors insulated with felted asbestos, covered with asbestos braid. Also in A.V.C. (asbestos and varnished cambric) constructions.

This heat-resisting flexible cord is ideal for high-wattage lighting units, floodlights, blueprint machines, apparatus, etc., which require a heavy duty, enduring cord. For moisture-resistant construction specify the A. V. C. type. Labeled cord with polarized conductors if desired.

600 VOLT A.V.C. BOILER ROOM WIRE—TABLE C

(Underwriters' Type AVA)

Sizes No. 18 to 4/0 A. W. G. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A. V. C. construction is ideal. Also for locomotive panel wiring and for switchboards requiring an asbestos braided wire.

ASBESTOS INSULATED MAGNET WIRE

Round, square and rectangular asbestos insulated conductors finished to meet varying winding conditions and coil treatment requirements.

Protect your motors against heat-induced breakdowns with class B windings of Rockbestos Heat-Resisting Magnet Wire. Leads of A. V. C. Motor Lead Cable will complete the failure-proofing.

THERMOSTAT CONTROL WIRE—TABLE TC

Sizes No. 14, 16 and 18 A. W. G. in two to six conductors with 12½, 25 or 31 mil wall of felted asbestos insulation and cadmium plated steel armor.

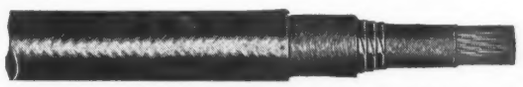
A multi-conductor control wire for low voltage intercommunicating, signal and temperature control systems. Its lifetime insulation and rugged steel armor will give you troubleproof circuits.

600 VOLT ALL-ASBESTOS RHEOSTAT CABLE—TABLE R

(Underwriters' Type AI)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with a heavy wall of felted asbestos, covered with a rugged asbestos braid finished in black, white or colors.

Use this power and rheostat cable for wiring rheostats, switchboards, elevator and locomotive control panels and electrical equipment exposed to heat, fumes and fire hazard. Also for general open wiring in dry, high temperature locations. For solid conductor specify Rockbestos Rheostat Wire, Table A.



600 VOLT A.V.C. MOTOR LEAD CABLE—TABLE L

(Underwriters' Type AVA)

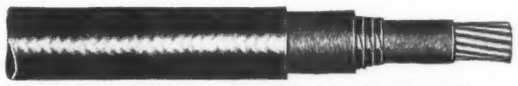
Sizes No. 18 A. W. G. to 1,000,000 CM insulated with two walls of felted asbestos and a high-dielectric, heat-sealed varnished cambric insert, covered with heavy asbestos braid.

Heatproof, fireproof, greaseproof and oilproof, this cable will not dry out and crack, won't burn or carry flame, and will remain permanently flexible. For coil connections, motor and transformer leads where extreme heat and fire hazards are encountered as in steel mills, boiler rooms, etc.

600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding A. W. G. No. 12—19/No. 25 and No. 9—19/No. 22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.



600 VOLT A.V.C. POWER CABLE—TABLE E

(Underwriters' Type AVA)

Sizes No. 18 A. W. G. to 1,000,000 CM insulated with laminated felted asbestos and varnished cambric, and asbestos braid. Other constructions for service voltages up to 8000.

This cable is recommended for power circuits and hot spot wiring in or around boiler rooms, ash pits, steam tunnels, soaking pits, tenter frames, glass plants, steel mills, etc. The asbestos and heat-sealed varnished cambric construction has ample moisture resistance and withstands high temperatures indefinitely.

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The Wire with Permanent Insulation

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SUHM SERVICE IS COMPLETE. It covers PERMANENT service for your Power Plant. It includes scientific analysis, treatment, recommendations on conditioning, blow-off, and all the other details that help you to greater efficiency.

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physics and metallurgy of welding and the weldability of steels; 2nd, welding and allied processes; 3rd, materials used; 4th, training, inspection and safety; 5th design considerations and testing of weld and 6th the applications of welding.

To insure accuracy, committee selected outstanding authorities as members of committees preparing the respective chapters. Altogether, this is an authoritative book on the technical phases of welding.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE—(7th Edition, 1942) *Published by the Lincoln Electric Co, Cleveland, Ohio. 1267 pages, 6x9 in., many illustrations, charts, tables, fabricated bound. Price $1.50 in the U.S.A., $2.00 elsewhere.*

Designed to provide as much complete up-to-date welding information as possible to help the war effort, the 7th edition, in addition to the regular welding data, gives the following new information:

Welding symbols, new allowable stresses, preheating for welding, stress relieving, flame cutting, ac versus dc for welding, plug welds, estimating costs, procedures, speeds and costs, automatic welding, "Fleet-Fillet" technique, easy-to-build testing machines, general metallurgical characteristics of metals and alloys, weldability of aluminum alloys, SAE steel numbering system, tubular construction, appearance and astyling in welding design, design of a press, list of cities with welding in building permit, rigid frame with fixed ends, rail end welding and information on 39 other arc-welding applications in manufacturing, construction and maintenance.

Plastics

PLASTICS (1942) *By J H Du Bois, plastic department, General Electric Co. Published by American Technical Society, Drexel Ave. at 58th St, Chicago, Ill. 295 pages, 5½ x 8 in., 131 illustrations, 37 tables, cloth binding. Price $3.*

For a long period of our industrial engineering history, wood, metals and alloys were looked upon as our basic materials. During many years this condition has been changing and a large variety of synthetic materials, known under the general heading of "Plastics", have been winning an important place for themselves in industry.

So much so that every engineer must now be familiar with them to properly do his job. Even in generation, trans-

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We've stepped up our service facilities to keep pace with war requirements . . . to serve everyone as promptly as possible. To date, no one has had to wait for Palmetto Packing.

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for steam, hot water, air. PALCO for water. PELRO for oils. CUTNO for alkalis. SUPERCUTNO (blue asbestos) for acids. KLERO for foods.
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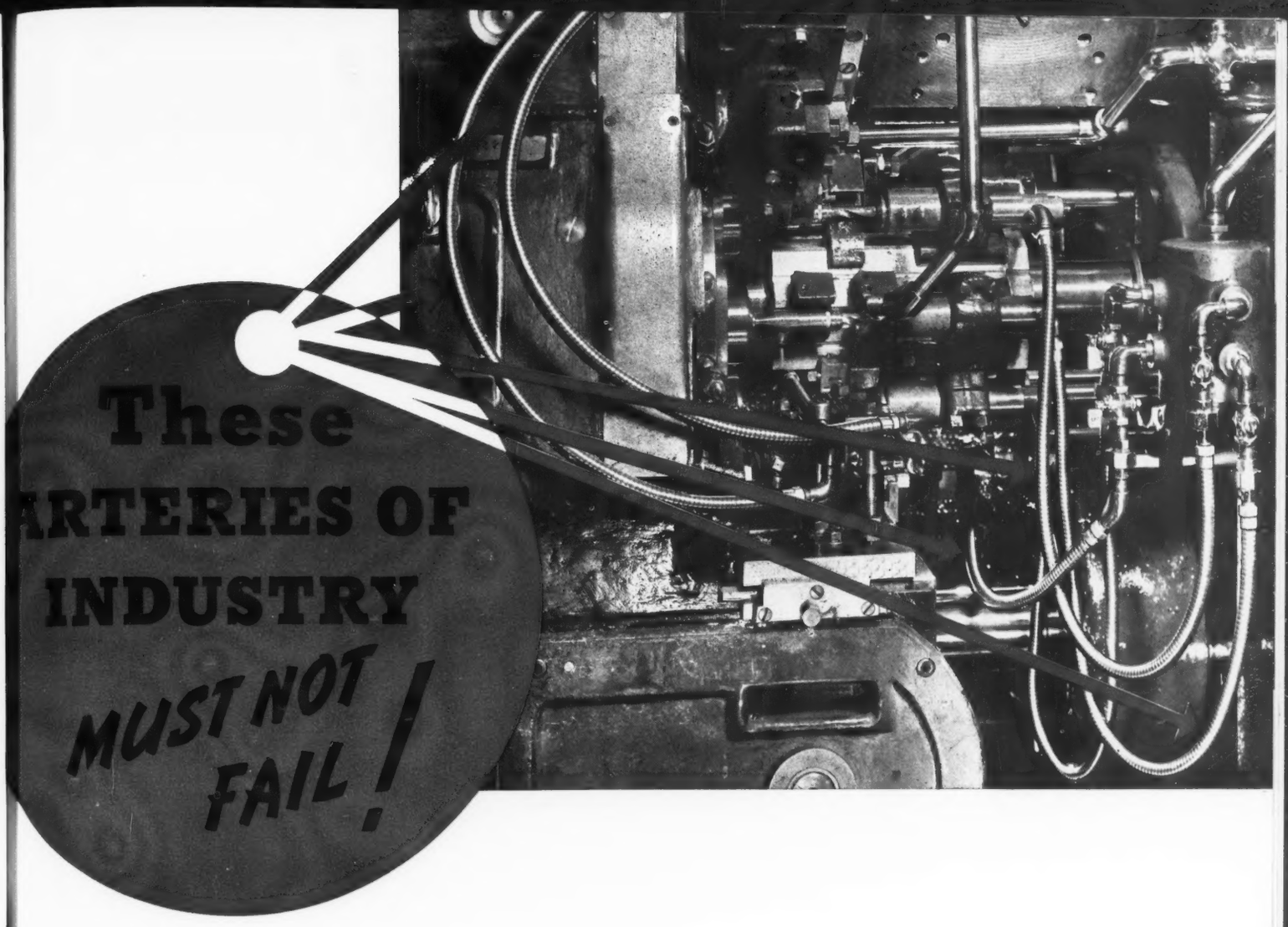

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The lifelines of this mechanical era of war and its industrial heart must be of such enduring strength and flexibility that there can be no question of failure.

Metal is the one dependable material possessing the characteristics to withstand all of the stresses of steam and air pressure, the deteriorating effects of oil, liquids and gases, and destructive vibration . . . and still retain the required flexibility.

American Seamless Flexible Metal Tubing, made by corrugating drawn rigid *Seamless* Tube, and American Metal Hose, wound from strip metal, are in the forefront of the battle lines . . . from the depth of sea and earth to the fighting heights of the stratosphere.

This company is still serving most of its regular buyers . . . because they have always been . . . and are now . . . the leading industrialists, whose production is the backbone of both peace and war. Added to these, of course, are the many new plants organized expressly for war production — whose use of American Flexible Metal Hose and Tubing is practically a necessity.

For all connecting and conveying duties, for vibration control, for the correction of misalignment and for protective shielding, there's a type of American Flexible Metal Hose or Tubing — some of which are shown on the reverse of this sheet.

Seamless SS-50 *graphically tells the story of American Seamless Flexible Metal Tubing — gives you important tables and accurate engineering data so necessary under present war conditions.*

Aircraft Bulletin A-48 *provides the essential facts in the form of up-to-the-minute specifications on American Metal Hose Aircraft products — flexible low tension shielded conduit, fittings, flexible aluminum and stainless steel tubing, ferrule attaching machines, etc.*

American Metal Hose

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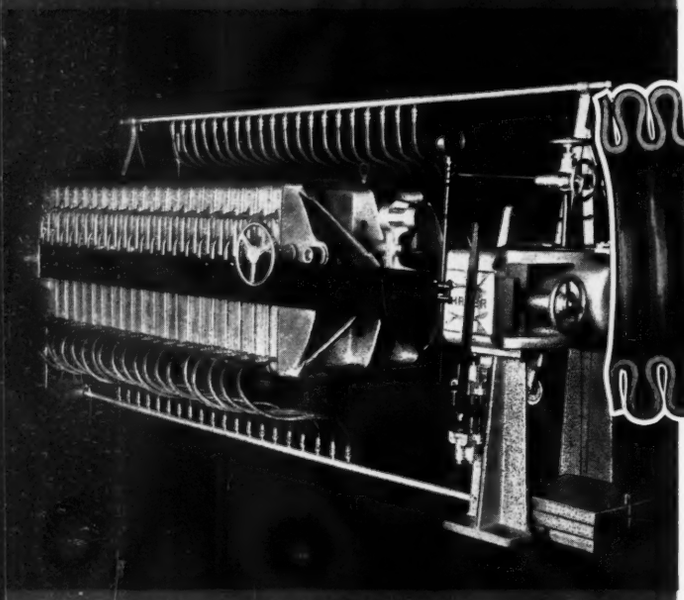
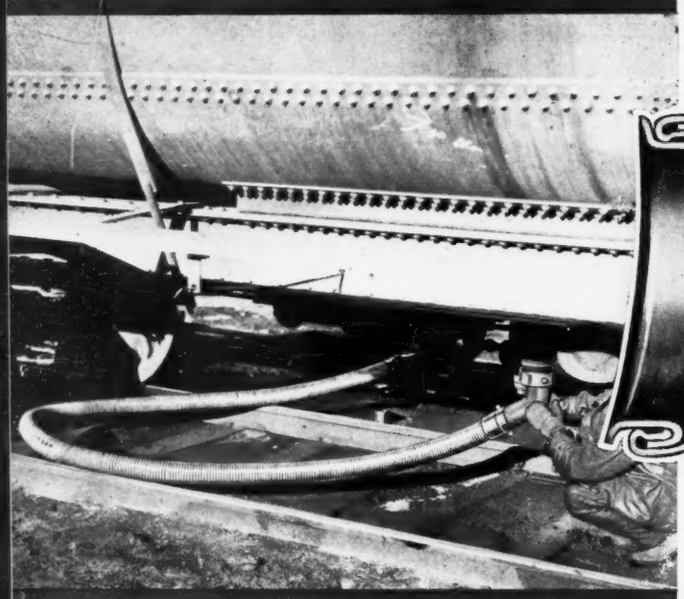
General Offices: Waterbury, Conn. • • Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

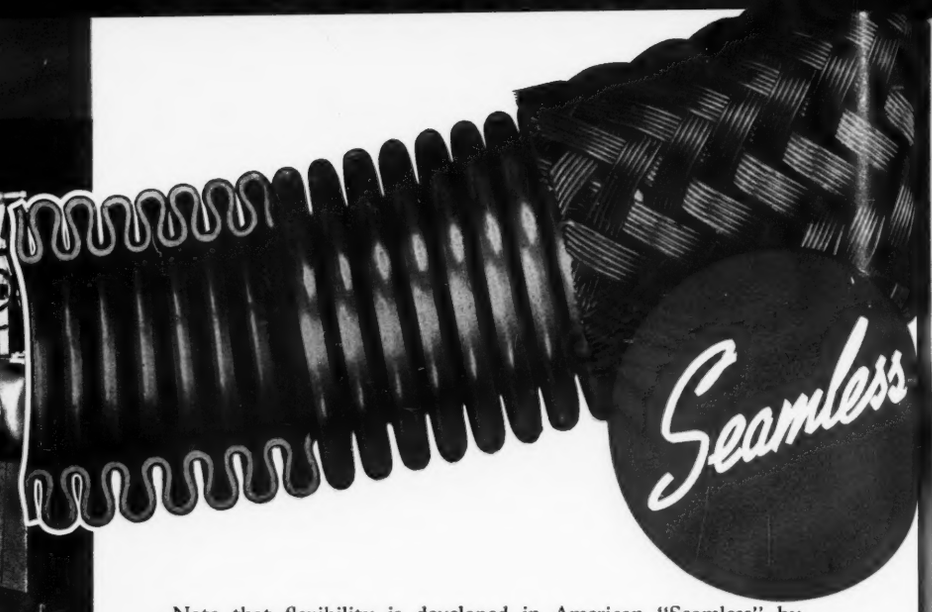


Large Filter Press equipped with American Seamless Flexible Metal Tubing for connections to steam feed and exhaust manifolds.

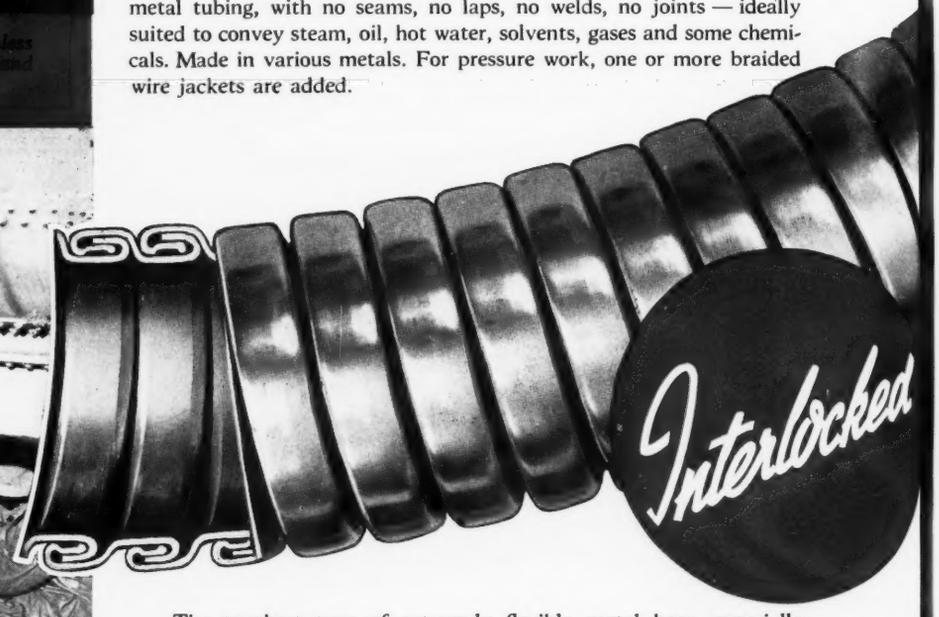


Unloading Oil Tank Car with a length of durable American Flexible Steel Oil Hose.

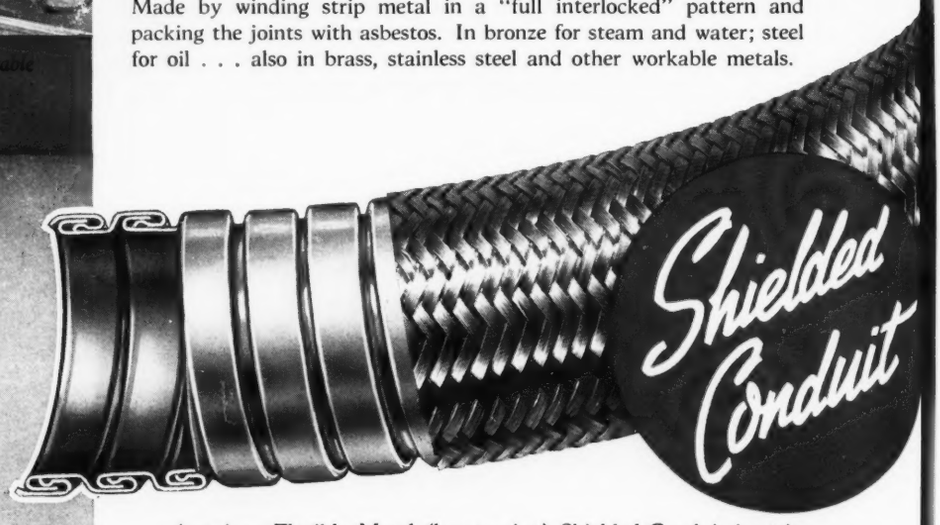
American Flexible Aluminum Shielded Conduit and conduit fittings are used on military aircraft for shielding the wiring of the electrical system.



Note that flexibility is developed in American "Seamless" by corrugating the solid walls of rigid metal tubing after it has been "stretched" to the correct wall thickness. Thus, a continuous flexible metal tubing, with no seams, no laps, no welds, no joints — ideally suited to convey steam, oil, hot water, solvents, gases and some chemicals. Made in various metals. For pressure work, one or more braided wire jackets are added.



The toughest type of extremely flexible metal hose, especially suited to "heavy duty" all around service in conveying steam and oil. Made by winding strip metal in a "full interlocked" pattern and packing the joints with asbestos. In bronze for steam and water; steel for oil . . . also in brass, stainless steel and other workable metals.



American Flexible Metal (low tension) Shielded Conduit is strip wound from aluminum. Used by the aircraft industry for shielding electrical wiring. Made to specifications of both the Army and Navy. Also available is a special flexible metal housing for parachute rip-cords; flexible heat ducts and shielded conduit fittings.

American Metal Hose

ANACONDA

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMP

General Offices: Waterbury, Conn. • • Subsidiary of Anaconda Copper Mining C

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Exide

BATTERIES
FOR CRANKING DIESEL ENGINES

THE more we save, the more we'll have. That's most important today. Wasteful buying, and wasteful misuse of equipment, are *out* for good.

Remember this, when caring for your dependable, long-lived Exide Batteries. Follow the simple rules printed on this page, follow them faithfully . . . and you're really working for America. Take care of your equipment, and help a lot of fighting Yanks take care of the Axis.

YOUR SCRAP will help WIN

AND HERE'S OUR PRESCRIPTION FOR BATTERY CARE!

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 2399.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

Save a Helper and Save Time with a ROTO TUBE CLEANER

Right now, when time and skilled labor are at such a premium, is an opportune time to consider the advantages which the New Roto Tube Cleaner can give you. A Roto operating air valve on the motor enables one man to clean tubes faster than when he has to depend upon a helper to turn on and shut off the air between every one of the hundreds of tubes cleaned. The Roto motor delivers more power per cubic foot of air consumed than ever before. Roto cutting heads, universal joints and accessories are built to make and keep customers satisfied. Your plant needs the kind of performance that Roto gives.

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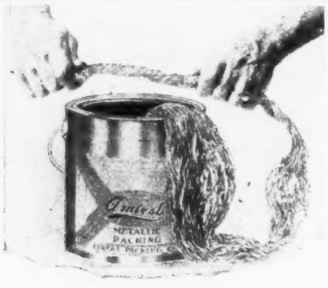
The ROTO Company

145 SUSSEX AVE., NEWARK, N. J.

Roto Model 130 air-driven motor with swing frame head and air valve for one-man operation.

Roto Junior Model 39 air-driven motor with pivot head.



Write for Working Sample
Send for 36 page catalog.

Put "AMBEST" to a long life test on any tough job

This UNIVERSAL packing—of long, pliable, anti-friction metallic alloy strands—assures low cost, long life packing protection and easy application on any rod in good condition. "AMBEST"—available for all pressures and temperatures up to 550° F.—is recommended for pumps, compressors, engines, throttles and valve stems. All needs are supplied by one packing when you use "AMBEST."

PATENTED "EUREKA" TRADE MARK

EUREKA PACKING CO., 294-296 46th St., BROOKLYN, N. Y.

mission and application of power, plastics occupy a rapidly expanding important position in the form of synthetic rubbers for insulation, packings, power transmission and conveying belts, etc. Many of the other plastics are used in a wide variety of forms for electric insulation, for bearings, gears, and for other purposes of interest to the power engineer.

This book is written for user and potential user of plastics who need basic information on these materials. It conveys useful knowledge concerning plastics, their history, origin, raw-material sources; their physical, chemical, mechanical and electrical properties, and their limitations; method of fabrication and essential information on their design. It is intensely practical and is written so as to be easily understood by everyone interested in plastics.

Engineering and Design

POWER PLANT ENGINEERING AND DESIGN (Second Edition). *By Frederick T Morse, associate professor of mechanical engineering, University of Virginia. Published by D Van Nostrand Co., 250 Fourth Ave, New York, N. Y. 700 pages, 6 x 9 in., illustrated. Cloth bound. Price $6.50.*

This revision of the original fundamental college text presupposes advance study of thermodynamics and heat power and therefore covers the engineering and design of actual modern power-plant equipment. Chapters on load problems, economics, and plant structures are followed by others on diesels, hydro plants, plant cycles, boilers, prime movers, condensers, combustion, feedwater, piping, electric system and operation. An excellent basic text for junior designing engineer or student of college grade.

Brief Reviews

BUILDING PRODUCTION MORALE—*Published by Northern Pump Co, Minneapolis, Minn.* This is a 40-page pictorial record of the Northern Pump Co's war production operations and morale methods. Explained fully are the methods used by the management, the workers, and the naval personnel at the plant in developing the high morale which won them the Navy "E", drove the plant two years ahead of schedule and caused the War Production Board to praise their work in its official progress report on the national war production drive. Copies of booklet available on written request to United States Navy, Public Relations Office, North-

BROWN FLOW METERS ... SECURE EFFICIENT POWER PRODUCTION

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TO win the war—It is a patriotic duty to *eliminate waste of power.*

To produce and use power more efficiently is the object of every industrial operation. For that purpose, good managers keep chart records of steam, air, oil, gas, water and other fluids.

Whether you buy steam or generate it in your own plant — every pound of steam saved — not only in the boiler room but in every department or unit where steam is used—assures Victory.

With Brown Flow Meters, you can correctly determine the cost of making steam for power, processing or heating and properly allocate costs to departments or units. Brown Flow Meter chart records show the rate of steam flow which enables operators to maintain the most efficient boiler operation, thus effecting substantial fuel savings.

An automatic planimeter pen record on rim of chart shows steam flow in volume units and the time at which it was produced or used in any part of the 24 hour period, and enables management to readily analyze steam production and distribution.

Thousands of plant engineers are getting this invaluable service from Brown Flow Meters. In many plants, the investment for Brown Indicating, Recording and Controlling Flow Meters has been repaid many times over. Write for catalogs.

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For Temperatures . . . . . Pressures . . . . . Flows . . . . . Liquid Levels

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Wadsworth Road, Perivale, Middlesex, England
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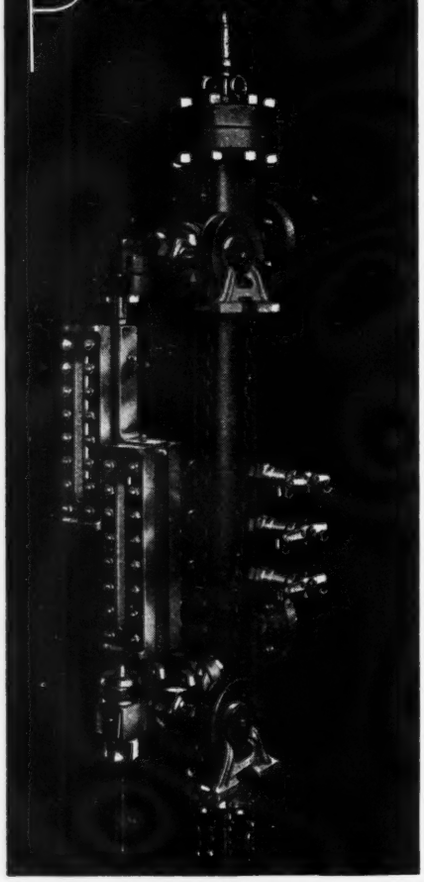
POSITIVE
Protection



Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1808. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN

western Bank Bldg, Minneapolis, Minn.

MAINTENANCE HINTS NOTEBOOK—*Published by Westinghouse Electric & Mfg Co, East Pittsburgh, Pa. 220 pages, 15 chapters for loose-leaf insertion in 5x7-in. binders. Two volumes, available to maintenance men on request to Dept 7-N-20.* Volume one covers inspection of electrical apparatus, insulation materials and applications, the cleaning, drying and testing of insulation, commutator maintenance, starting and regulating ac and dc and squirrel-cage motors. Vol two is devoted to contactor maintenance, inspection of transformers and a chapter on transformer connections. Wiring diagrams show all of the more common connections for two and three phase, 25 and 60 cycle, power transmission.

SOUND MEASUREMENT TEST CODE FOR CENTRIFUGAL AND AXIAL FANS—*Published by the National Association of Fan Manufacturers, General Motors Bldg, Detroit, Mich. Price $.10.* Provides standard method of measuring sound in fans and blowers.

PROCEEDINGS—36TH ANNUAL CONVENTION—SMOKE PREVENTION ASSOCIATION OF AMERICA, INC. *Published by the Smoke Prevention Association of America, Inc, 139 N Clark St, Chicago, Ill. Paper bound, 138 pages. Price $1.00.* Complete proceedings of the 36th annual convention, held at the Hotel Statler, Cleveland, Ohio, June 2-5, 1942.

LEFAX DATA—*Published by Lefax, Inc, Philadelphia, Pa.* Herewith are recent data in loose-leaf form of interest to power men: No. 5-218, "Cast-Iron Screwed Fittings"; No. 14-217, "Electric Corona"; No. 6-251, "American Standard for Taper and Straight Pipe Thread"; No. 14-6 "Monel Metal—Its Physical Properties and Uses"; and No. 42-25 "Pipe Fittings—Simplified Practice".

PROBLEMS AND PRACTICE IN DETERMINING STEAM PURITY BY CONDUCTIVITY METHODS—*a symposium of technical papers and discussions published by the American Society for Testing Materials, 260 South Broad St, Philadelphia, Pa. Price 60 cents.* Papers include such subjects as sampling of steam and boiler water, correction for dissolved gas in condensate, conductivity apparatus and conductivity cells. A valuable bibliography includes some 75 important references.

FATIGUE OF METALS (second edition) *by D Landau.* An 88 page booklet dealing with the mechanism of fatigue is available to designing engineers,

XZIT
FIRE SCALE & SOOT ERADICATOR

...reduces deposits in all types of boilers using all kinds of fuel ...speeds cleaning ...increases efficiency

XZIT—a scientific, proved chemical compound—definitely reduces carbon deposits on boiler heating surfaces, uptakes, breechings and stacks. While not a substitute for blowing or brushing, XZIT greatly increases the efficiency of these operations and reduces their frequency. XZIT not only makes it easier to remove carbon deposits but tends to prevent further accumulation of soot and fire scale. It is harmless to metal or brick and prevents sparks and stack fires.

OFFSETS EFFECTS OF INFERIOR FUELS

XZIT is effective regardless of the type of boiler or the kind of fuel used. It is ideal for use where fast carbon-deposit-forming fuels are used. It provides a valuable method of counteracting the soot-forming and efficiency-lowering conditions resulting from todays necessity for using inferior fuels.

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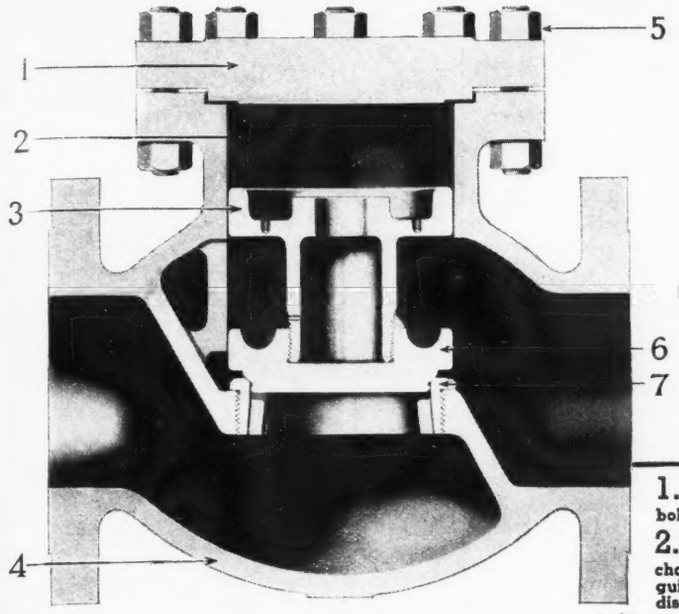
A thorough trial with XZIT will prove its value. We will gladly supply a sufficient quantity for test with no cost or obligation unless you are thoroughly satisfied with results. ACCEPT THIS TRIAL OFFER TODAY. You'll quickly prove the value and economy of XZIT just as thousands of other plants have done.

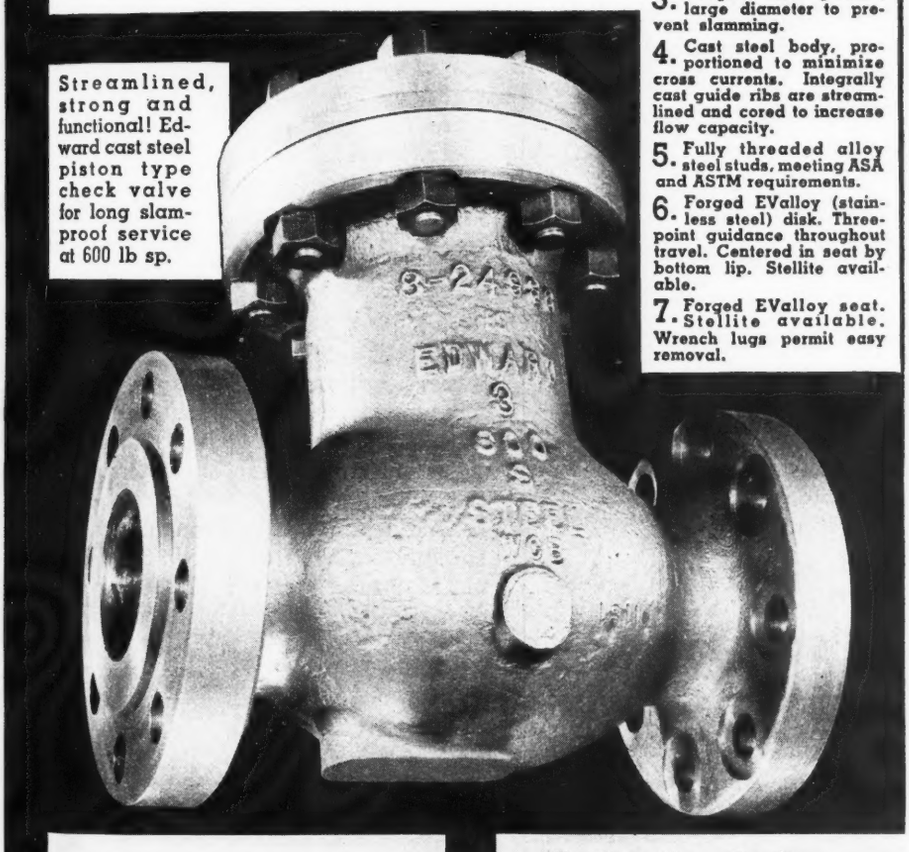
Openings are available for sales representatives in a few desirable territories.

XZIT SALES CO.
1031 CLINTON STREET
HOBOKEN, NEW JERSEY

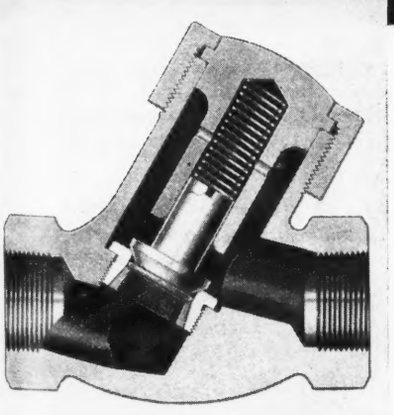
CUT SHOCK, SLAM and CLATTER with EDWARD *Piston Type* Check Valves

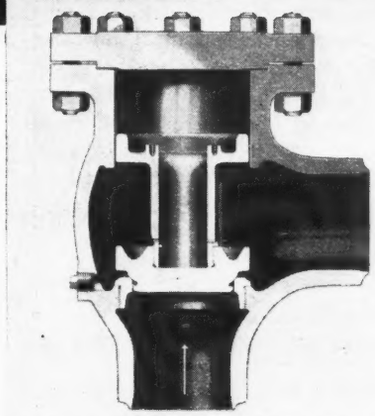


1. Forged steel cover, through bolted to body.
2. Smooth, self scouring piston chamber for accurate guiding of piston-disk assembly.
3. Forged steel piston, large diameter to prevent slamming.
4. Cast steel body, proportioned to minimize cross currents. Integrally cast guide ribs are streamlined and cored to increase flow capacity.
5. Fully threaded alloy steel studs, meeting ASA and ASTM requirements.
6. Forged EValloy (stainless steel) disk. Three-point guidance throughout travel. Centered in seat by bottom lip. Stellite available.
7. Forged EValloy seat. Stellite available. Wrench lugs permit easy removal.



Streamlined, strong and functional! Edward cast steel piston type check valve for long slam-proof service at 600 lb sp.





VIBRATION, clatter and damaging shock to piping are cut to a minimum with Edward piston type check valves.

Cast steel in sizes above 2 in., forged steel in the smaller sizes, they all incorporate exclusively Edward design features that cushion disk action and yet give fast, sure closure.

In the cast steel horizontal and angle series, an "hour glass" disk-piston assembly moves in a mirror smooth body piston chamber, guided throughout travel by three streamlined ribs, integrally cast with the body. Thus, kept in proper position to enter the seat at all times, there is no danger of the disk "hanging up."

Correct clearance between piston and dashpot, and large piston diameter effectively dampen disk action during sudden flow reversal. Full area streamlined bodies give maximum freedom for flow.

The same principles are used in the design of Edward forged steel check valves, except that in some series a spring is used to aid seating.

For descriptions and dimensions, write for Edward Better Valves Catalog No. 101.

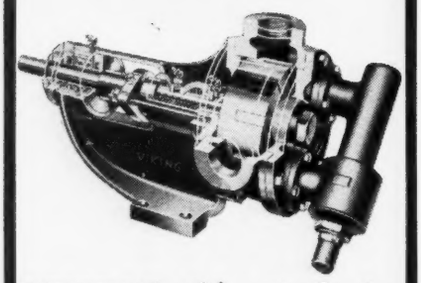
THE EDWARD VALVE & MFG. CO., INC.
1220 WEST 144TH STREET
EAST CHICAGO, INDIANA

EDWARD *Steel* CAST AND FORGED **VALVES**

Edward screwed end forged steel check valves, in sizes ¼ to 2 in., give same freedom from excessive vibration as larger Edward check valves. Spring loaded forged steel checks may be installed in horizontal or vertical lines. For 150 to 6000 lb.

Edward angle check construction is illustrated by 900 lb sp valve above, which has bevel welding ends. Socket or bevel welding ends are available, as well as flanged ends. Integral Stellite seats, and Stellite disks can be furnished, too.

The ANSWER TO MANY A TOUGH PUMPING PROBLEM



VIKING Heavy-Duty ROTARY PUMP

If you're up against a special problem, such as the pumping of viscous materials, unbalanced pressure conditions, varying loads, or some other unusual application, the heavy duty Viking Rotary Pump probably can do the job.

Available in capacities from 10 to 300 GPM. Larger sizes up to 1050 GPM for heavy duty service. Furnished in many mounting styles, including gear drive, V-belt drive, direct connected and double back-geared.

Bulletin 2500-40 illustrates and describes the many types and sizes of heavy duty Viking Rotary Pumps. Write for your copy today. It's FREE.

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UNCLE SAM'S ORDERS

When ordering pumps or parts, it is necessary to give us your priority rating and allocation symbol. Be sure to obtain the highest rating possible. Priority regulations are changed frequently. Check up and see if changes made improve your rating. Thank you.

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VIKING PUMP COMPANY
CEDAR FALLS, IOWA

schools, colleges, universities and government technical bureaus on request from the Nitralloy Corp, 230 Park Ave, New York, N. Y. A clear explanation of the factors that enter reduced ability of metal to carry loads under variable stress, overstress, corrosion and design based on fatigue data plus an appendix on fatigue testing machines.

ENGINEERING INDEX (57th Edition—1941) *Published by Engineering Index, Inc, 29 West 39th St, New York, N. Y. Price $50.00.* Covers all branches of engineering and contains 26,000 annotations of important articles published in current technical periodical literature during the year, and 40,000 cross-references to these annotations. Also has a list of publications reviewed and an author and contributor index.

SCRAP AND SALVAGE MATERIALS FOR THE UTILITIES—A booklet prepared by War Production Board's Industrial Salvage Section on best methods of reclaiming pole hardware, wire, cable, tools, solder, rubber and copper to save new strategic materials. Available on request from Industrial Salvage Section, WPB, Washington, D. C.

INDUSTRIAL COMMERCIAL AND INSTITUTIONAL PROJECTS — Published by Lockwood Greene Engineers, Inc, 10 Rockefeller Plaza, New York, N. Y. Outlines firm's engineering and appraisal services to industry and commerce. Contains partial list of clients together with illustrations showing typical construction work.

Power Lines

(*Continued from page* 130)

In addition to regular salvage department activities, Westinghouse has recently inaugurated periodical intensified clean-up drives for salvagable material and scrap. Recently in one department of the East Pittsburgh Works, one of these four-day drives uncovered more than 300,000 lb of scrap metal that could be turned over for reworking.

Ten Ways to Save Critical Materials

Tons of critical materials, particularly copper, can be saved by following these ten principles in installing war-

TIME SAVED ON POWER PLANT MAINTENANCE JOBS Helps Nation's War Effort

For Example:

CLEANING SURFACE CONDENSERS

If low vacuum is impairing operating efficiency of your surface condenser, remove those lime-scale, lubricating oil or other insulating deposits on tube surfaces causing the trouble. Do this job the FAST, EASY Oakite way . . . and you will shorten equipment down-time!

Method is relatively simple, requires no dismantling of equipment. Just circulate a solution of the recommended Oakite material through steam or water side of tubes as directed...rinse ...and deposits are thoroughly, speedily removed! Higher vacuum is obtained, steam and fuel consumption reduced, efficiency increased.

NEW, FREE DIGEST Gives Details!

Send today for new, FREE Digest giving details for handling this and 27 other essential maintenance jobs faster, easier, better the money-saving Oakite way!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Representatives in All Principal Cities of the United States and Canada.

OAKITE Specialized cleaning
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Help Them Win...Turn in Your SCRAP!

Scrap is steel or iron useless in its existing form but valuable as *raw material* for remelting. Since it is already refined, more scrap in the furnace charge speeds up the refining process and enables steel to be turned out faster for implements of war . . . More scrap—*from your plant*—means more steel.

Conservation Authorities Recommend the Following 8 Steps

1. Put some one individual in charge of scrap in all departments of your business and GIVE HIM AUTHORITY TO ACT.

2. Comb the plant and yards for dormant scrap, abandoned equipment, old boilers, pipe, moulds, obsolete dies and parts, material now being destroyed which has salvage value.

3. Survey all plant equipment, particularly idle standby or discarded machines, with a view to applying or converting them to useful production.

4. SEGREGATION: Identify, classify and segregate scrap and supervise its handling to avoid contamination. This will increase its value. Provide separate containers, clearly marked for each class of scrap material.

Repair or rework worn or broken cutting tools. Keep unusable small pieces and turnings segregated. Even high speed steel grinding dust is valuable.

Dismantle discarded equipment promptly into its components — electrical, fastenings, lumber, etc. — so that these parts may be utilized or scrapped.

Sort blanks, short ends, cut-downs, clippings, etc., for possible reuse for smaller parts made in the same or other departments.

Recover and reclaim used cutting oils, lubricants, surplus paints and spray finishes.

Sort sweepings and miscellaneous waste to recover scrap values.

5. Constant reminders in the form of posters, illustrations of right and wrong methods, pay envelope enclosures, house organ publicity, etc., are potent aids to the conservation program.

6. Release for scrap, obsolete engravings, electrotypes, and standing types for catalogs, forms and advertising material.

7. Inspect all refuse to detect avoidable waste and excessive rejections. Educate production executives to correct such conditions at the source.

8. For information and assistance on special phases of conservation and salvage communicate with Industrial Salvage Section, Conservation Division, War Production Board, 9th Floor, Washington Gas Light Building, Washington, D. C., or with nearest regional office.

The metallurgical experience of our technical staff is available to aid you in these and other technical phases of metal salvage.

KEEP SCRAP MOVING INTO WAR PRODUCTION!

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.

42
800
1630

SO NIGHT WORKERS MAY SLEEP DAYS

This war worker's flag, displayed outside a home during daytime sleeping hours, silently asks neighbors to be quiet. This idea, promoted by a prominent New England Department Store, is sweeping the country.

HOW INDUSTRY CAN COOPERATE

Industrial plants, power houses, etc., located near residential districts, may easily cooperate in this worthwhile movement by silencing such noises as stationary gas, gasoline and Diesel engine exhausts, the roar of steam blow-offs and compressor intake suction.

Maxim Silencers, pioneer equipment for the suppression of such preventable noises, may be installed on exhaust or intake lines to operate effectively, year after year, with practically no maintenance.

Write to

The Maxim Silencer Co.

92 Homestead Ave., Hartford, Conn.

MAXIM SILENCERS

plant power distribution systems, according to H V Erben, Manager of General Electric's central station department.

1. Calculate as accurately as possible what the *actual* load will be and design the system to carry only that load—not on the basis of connected load.
2. Keep to the practicable minimum the distance over which the electric power is to be carried.
3. Transmit power at the highest practicable voltages and bring the high-voltage distribution as close to the load as possible.
4. Correct for low power factor at a point as close to the reactive load as possible.
5. Use compact, standard equipments. This not only saves copper, time, and money but also makes possible quick replacement in case of trouble.
6. Arrange layouts to limit circuit-breaker interrupting requirements to the optimum values, thus saving copper in buses and breakers.
7. Use 3-phase power transformers wherever feasible.
8. Use forced cooling on power transformers wherever it is practical.
9. Select cables with insulation which will permit maximum load per unit of copper.
10. Limit the number of cables per duct bank to the minimum to avoid loss of current-carrying capacity.

OBITUARIES

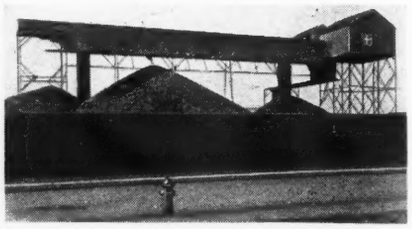
WILLIAM M FRANCIS, 73, district manager since 1898 of the Hartford Steam Boiler Inspection & Insurance Co in Atlanta, Ga., died in that city on Sept 2. He had been the company's oldest employee in point of service.

WILLIAM R ELDEN, 59, manufacturers' representative of New York, died in a Teaneck, N. J., hospital on Sept 2, 1942. Mr Elden was formerly a sales engineer for the Lidgerwood Mfg Co until 1901, and from 1905 to 1921, when he joined Sauerman Bros, Inc, of Chicago, where he remained as chief engineer until 1939. In 1939 he opened his own office in New York City to represent Sauerman Bros, Inc, and other manufacturers.

LEWIS M DWYER, 73, sales manager of the Grinnell Co, Providence, R. I., died at Cranston, R. I., on Aug 8.

EDWIN H BREVILLIER, 64, died Aug 10, 1942, after a short illness, at his residence in Erie, Pa. He was president of the Union Iron Works at the time of his death, having been elected

Coal Storage now War Business



All government departments urge ample coal storage NOW—to relieve transportation, reduce manpower in mines, prevent interruption of industrial production.

COAL STORAGE IS A GIFFORD-WOOD SPECIALTY

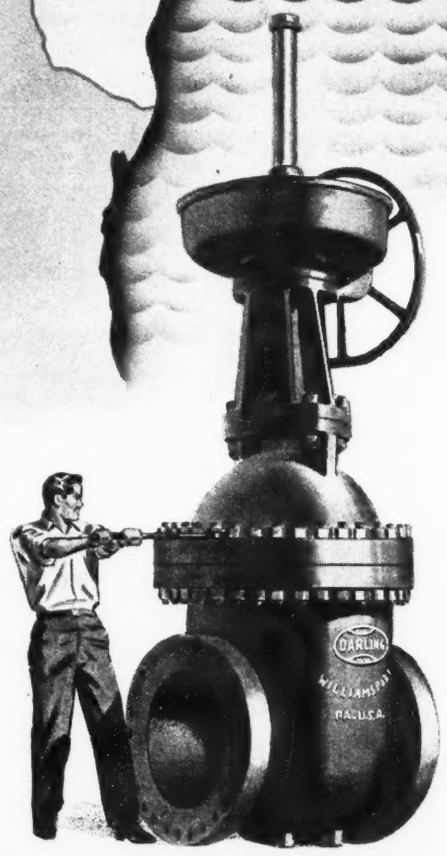
Such important problems as segregation, breakage, slacking, spontaneous combustion and related considerations are old stories to GIFFORD-WOOD. Most of the outstanding retail coal storage plants in the East are Gifford-Wood designed and produced. So, also, are many important industrial coal storage as well as coal and ash handling plants.

If you have a coal storage plan under consideration, save time, work and money by calling in a G-W engineer.

2494

GIFFORD-WOOD CO.
Founded 1814
HUDSON, N. Y.
NEW YORK 20 Lexington Ave.
CHICAGO 565 W. Washington St.

A NEW NON-SUB HIGHWAY *for America's Crude Oil*



Today, a new and vital pipe line is being rushed to completion from the oil fields of Texas to a terminal in Illinois. It's a 500-mile super pipe line, the largest ever built, that will deliver 300,000 barrels of crude a day—and will *deliver it safe* from enemy sub attacks.

Darling's unique Parallel Seat Fully Revolving Double Disc design provides the pipe line engineer with the things he wants—easy operation, positive shutoff, low maintenance cost, and dependability—that is why Darling was chosen for this vital job.

The Darling Valve & Manufacturing Company has been at it for over 50 years, designing and constructing valves, not only for pipe lines, but also for the severest service operations that confront industry—*any industry.*

When you have tough problems in the control of liquids or gases, a Darling engineer can help you. Phone, wire or write the Darling Valve & Manufacturing Company, Williamsport, Pa.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

You will find the metal protractor a useful, convenient tool, and the SMOOTH-ON Handbook will help you repair plant equipment that you cannot replace because of war-time conditions. Some of the subjects covered:

How to seal cracks in casings or shells of pumps, heaters, condensers, evaporators, tanks, engines, valves, etc.

How to stop leaks at seams, bolts, rivets, threaded or flanged joints, etc.

How to tighten loose parts of apparatus, fixtures, etc.

How to waterproof concrete, brick or stone floors, walls, etc.

How to improve the appearance of rough or blemished machinery bases and other castings

How to make up leak-proof pipe joints

SMOOTH-ON USERS!

Write us how YOU have used SMOOTH-ON to repair your plant equipment, so that we can tell other engineers about your experiences. Your cooperation will help to save much-needed metal and apparatus, thereby aiding the Nation's war effort.

. . . a dependable iron cement that, since 1895, has been used by engineers and mechanics for making lasting repairs. Buy from your supply house or if necessary, direct from us, in 7-oz., 1-lb., 5-lb cans, also larger kegs.

MAIL COUPON TODAY

Smooth-On Manufacturing Co., Dept. 30,
570 Communipaw Avenue,
Jersey City, New Jersey

Please send the FREE Protractor and Smooth-On Handbook.

Name .....

Address .....

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Do it with **SMOOTH-ON**

to that office in 1941. Since 1934 he had been vice-president. He became associated with Union Iron Works in 1906, having previously been connected with the firm of Johnson & Brevillier, after attending the University of Pennsylvania.

W A STUBBLEBINE, a pioneer in the field of pulverized coal firing, died on Aug 27, 1942. Mr Stubblebine began his career with Bethlehem Steel Co in 1895, and for the next fourteen years was engaged in drafting, engineering and construction work for steel companies. In 1909 he went with the Fuller-Lehigh Co, Fullerton, Pa., where he was active in the development of pulverized coal firing and furnace construction. In 1923 he was transferred to the Trumbull Steel Co of Warren, Ohio, where he had charge of one of the pioneer pulverized coal-fired boiler plants. In 1927 he returned to the Fuller-Lehigh Co which had been acquired by the Babcock & Wilcox Co. For three years he was representative of the Fuller-Lehigh Co abroad, with headquarters in London, England. Since 1931, when the operations of the Fuller-Lehigh Co and the Babcock & Wilcox Co were consolidated, Mr Stubblebine had been located in the general office, New York where he was active in the design and operation of pulverized fuel installations. He was a member of the American Society of Mechanical Engineers.

HUGO D SHARP, 57, New England manager of the electrical, wire rope and construction materials department of the American Steel & Wire Co, Boston, died suddenly at Sutton, Mass., on Aug 22. He was born in Sweden and had been with the company 42 years, being widely known in electrical and construction circles.

CHARLES R MAIN, 57, former treasurer of the consulting engineering firm of Chas T Main, Inc, Boston, Mass., died at Winchester, Mass., on Aug 22. He was born in Lawrence, Mass., and was educated at Thayer School of Engineering and the Massachusetts Institute of Technology.

CHARLES A UNDERWOOD, 50, engineer in charge of the refractories department of the New England office of the Babcock & Wilcox Co, died at a local hospital on Aug 29. He was born in Newport, R. I., was a graduate of the Worcester Polytechnic Institute, and had been with the Boston branch of the company for 19 years.

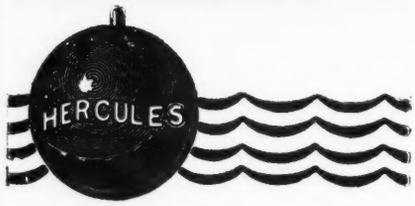
FRANCIS J AREND, founder and president of the De Laval Steam Turbine Co.

DE LAVAL-IMO PUMPS

FOR its production of IMO pumps and other marine equipment, permission has been awarded to the De Laval Steam Turbine Company to fly the Navy "E" burgee, emblem of outstanding excellence, and to De Laval employees to wear the Navy lapel insignia in evidence of work "Well Done."

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton, New Jersey

HERCULES
Seamless Copper
FLOATS



GUARANTEED TO STAND UP!

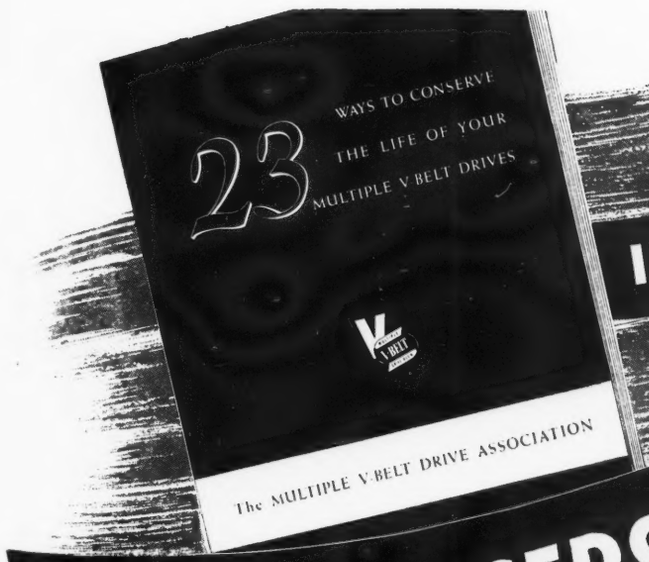
Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

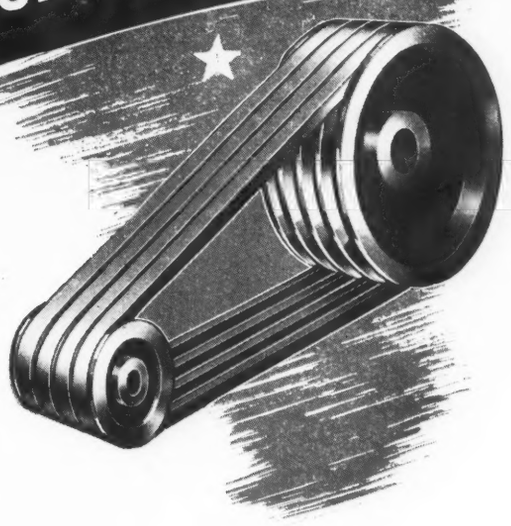
Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.



IT'S FREE . . .

POWER USERS—YOU NEED THIS BOOK TO CONSERVE YOUR V-BELTS!



IN THE PRESENT all-out battle for production that will not end until Victory has been won, the war material industry will continue to depend on Multiple V-Belt Drives for efficient and continuous power transmission.

In peace time, it's just common sense and good business to get the utmost service out of every V-Belt. Today, the rubber shortage makes strict conservation not only necessary, but a patriotic duty.

To help power users lengthen the life of their V-Belts, the members of the Multiple V-Belt Drive Association have published a book that tells just what to do and what not to do in selecting, installing and maintaining Multiple V-Belt Drives.

This timely book will be sent free to any power-user. Write or mail coupon for your copy.

MULTIPLE V-BELT DRIVE ASS'N
TRADE MARK

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of cooperative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN ST., CHICAGO

Multiple V-Belt Drive Association
140 S. Dearborn St., Chicago
Please send us a copy of your free book, "23 Ways to Conserve the Life of your Multiple V-Belt Drives."

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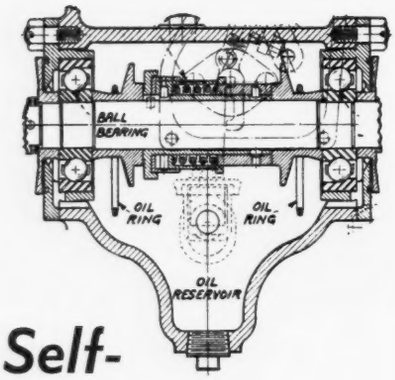
Address.....



Self-Lubricated

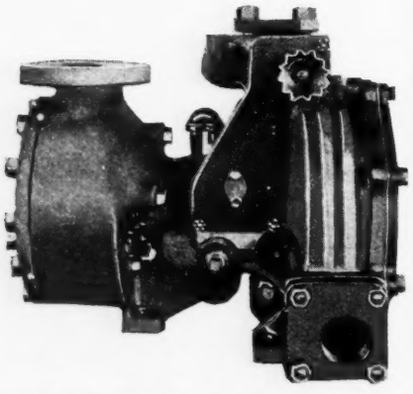
The COFFIN-Steam Turbine CENTRIFUGAL PUMP

Self-contained ring type lubrication, supplied from a centrally located oil reservoir within the housing, makes the Coffin pump independent of external lubricators.

The oil level is maintained and the reservoir refilled by means of the single oil cup provided.

The temperature of the oil in the reservoir is water cooled by means of a continuous coil when cooling is required.

PRESSURES
To 750 Lbs. Sq. In.
DELIVERIES
To 500 G.P.M.



THE J. S. COFFIN, JR., CO.
ENGLEWOOD, N. J.

died Aug 24, 1942, at Neptune, N. J. He was also president of the De Laval Separator Co. A leader in the separator industry in the United States, he had been with the De Laval Co since early youth. Several years ago Mr Arend was decorated by the Swedish government, the De Laval separator being a Swedish invention.

PERSONALS

R J LAIDLAW has been appointed manager of the Cleveland office of the Worthington Pump & Machinery Corp. Mr Laidlaw has been connected with the Worthington organization in various capacities since his return from overseas in 1919 from active service with the 32nd Division of the 120 M. G. Battalion in World War I.

THOMAS MATCHETT, president of Robins Conveying Belt Co, Passaic, N. J., has been appointed to the Conveyor and Mechanical Power Transmission Industry Advisory Committee of the War Production Board.

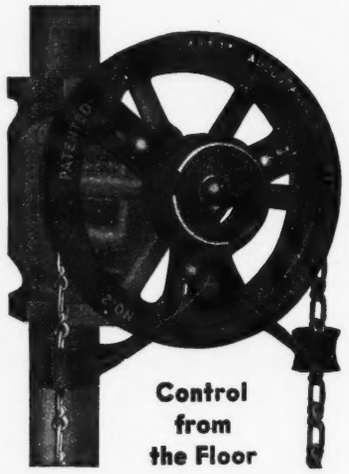
C R CLINGMAN of Detroit, Mich., has recently joined the sales force of the Honan-Crane Corp of Lebanon, Ind. He will be in charge of the New Orleans area and his office will be located at 631 Maison-Blanche Building, New Orleans, La. Mr Clingman has been with the Gulf Oil Corp for the past eight years, and previous to that has had many years of experience as a mechanical and industrial plant engineer.

JOSEPH E MOODY has been appointed manager of industrial relations for the New York Ice Machinery Corp. This will mean the establishment of a new division in the administration of York Ice Machinery Corp. Mr Moody's duties will embrace all phases of industrial and personnel relations.

H E BECKER, a Westinghouse sales engineer on the Pacific Coast since 1935, has been appointed supervisor of the newly created maintenance sales department for the company's Pacific Coast district. In his new post, Mr Beck will coordinate the work of three major maintenance divisions of the company—renewal parts, field engineering and repair plants—to minimize breakdown outages and insure uninterrupted production in industrial plants. In addition to industrial plants, he will coordinate maintenance of existing Westinghouse equipment in the marine industry, and electric utilities, and on transportation systems.

PHILIP S MANCINI has been appointed public service engineer for the

Make Your Overhead Valves SAFE And Easy to Reach---



With the Babbitt Rim for Valves you eliminate danger and banish the step-ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

BATESGRATES
FILLET WELD
Open Steel Floor Grating

Easily maintained - - -
NO CRACKS, JOINTS, CREVICES

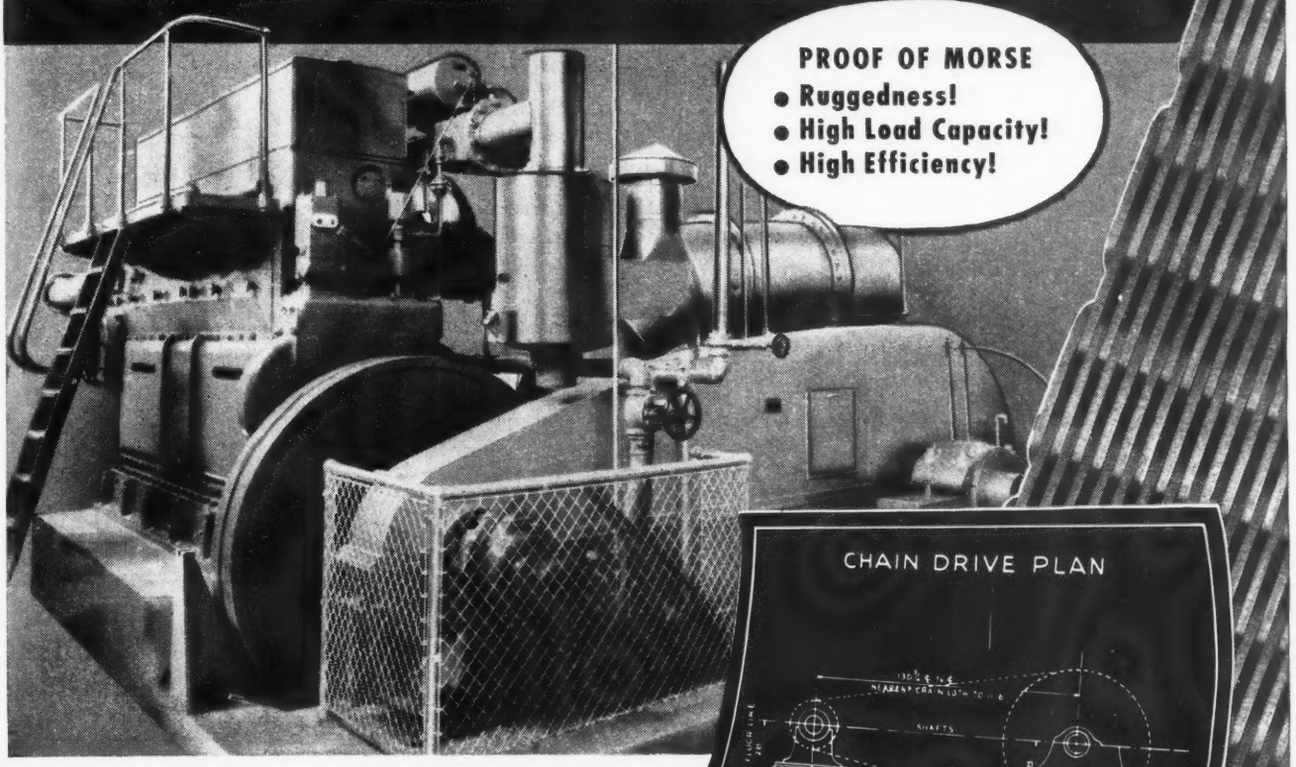
Batesgrates are self-cleaning because of peaked, non-skid cross bar. They have no grooves or rough burned metal to catch grease or dirt. Safe traction. Batesgrates are strictly one piece—no cuts, slots, or punching. Made from Hexagon Shaped Hot Rolled Steel Bars with smoother, larger, much stronger welds. Send today for engineering Catalog No. 42.

When you need grates
SPECIFY BATES
for long-time economy

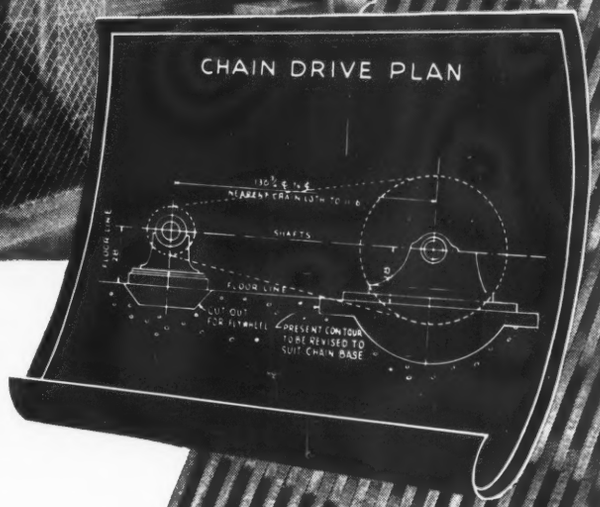
WALTER BATES CO.
208 S. LaSalle St. Chicago, Ill.

TEXAS too, keeps the Pressure Up

500 H.P. Water Pump driven with MORSE SILENT CHAIN DRIVE...



PROOF OF MORSE
- **Ruggedness!**
- **High Load Capacity!**
- **High Efficiency!**



IN WESLACO, TEXAS, power for maintaining water irrigation supply throughout two counties is efficiently transmitted from a 540 H.P. gas engine operating at 360 RPM to a low head pump at 120 RPM by means of a Morse silent chain drive. The long history of such installations shows the ruggedness, dependability, and smooth quiet action of Morse drives.

Extremely compact, Morse Chain Drives are low in first cost, require practically no maintenance, and operate at 99.4% efficiency.

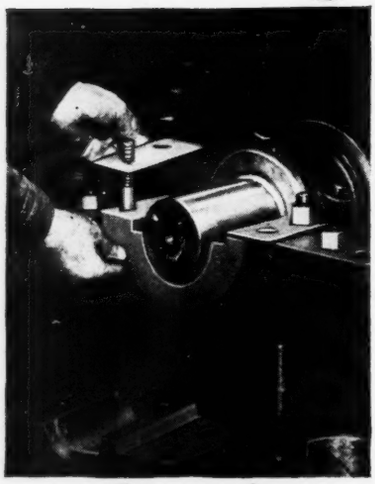
Whether your drive requirements be conventional or unusual, there is a Morse Silent or Roller Chain Drive in single and multiple widths to fulfill your exact demands. Sizes from fractional to 5000 horsepower. Morse Representatives everywhere are ready to help increase your productive output—engineer chain drives to the job.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP

start



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URGENCY of production requires precision fit in less time! By peeling Laminum shim adjustments you speed accurate assembly . . . and make possible the same easy adjustments in field service.

Laminum shims (.003 or .002 in. laminations bonded into a solid unit easy to peel) are cut to your specifications.

Stock shim materials obtainable from mill supply dealers. (Write us for sample and illustrated shim application file-folder.)

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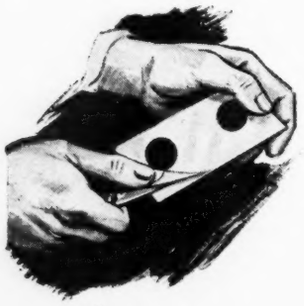
61 Union Street Glenbrook, Conn.



it's

LAMINUM

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

city of Providence, R. I., succeeding the late Ralph W Eaton. The office carries with it the duties of traffic engineer and smoke inspector, as well as relations with various public utilities. In his early career Mr Mancini was assistant engineer in the department, and for the past five years was deputy public service engineer.

ROY M SMITH has joined the Roller-Smith Co, Bethlehem, Pa., as assistant chief engineer. Mr Smith comes to Roller-Smith from the Bryant Electric Co, where he was engineering manager for the wiring device division. Prior to this he was with the Westinghouse Electric & Mfg Co as section engineer on relay design and application.

HAROLD L ROWLAND has been appointed to the administrative staff of the Carrier Corp of Syracuse, N. Y.

BUSINESS ITEMS

WHEELCO INSTRUMENTS CO, Chicago, announces three appointments to the company's sales and service organization. C L Clark, of Westinghouse Electric & Mfg Co for the last 13 years, has been attached to the Cleveland office as sales engineer. Robert N Miller, for the past seven years, sales and service engineer for the Mercoid Corp in Chicago, is now service engineer with the Wheelco Cleveland office. Howard B Jones, formerly with the McGraw-Hill Publishing Co, has been employed as sales and service engineer at the Chicago office.

The Barberton works of the BABCOCK & WILCOX CO, New York, was awarded the Maritime Commission "M" burgee in recognition of outstanding achievement by the company. The "M" burgee now flies alongside the Navy "E" burgee, which was awarded to the company on May 11. The award was presented on Sept 2 by Rear Admiral Emory S Land, chairman of the U S Maritime Commission and administrator of the U S War Shipping Administration.

TECHTMANN INDUSTRIES, INC, will be the new name of the Pack-Rite Machine Corp, 828 N Broadway, Milwaukee, Wis. "Pack-Rite Machines" will be continued as a division of Techtmann Industries, Inc.

WHEELCO INSTRUMENTS CO, Chicago, announces three new South American sales outlets. Cia Argentina de Ingeneiria Industrial, with headquarters at 375 Peru, Buenos Aires, will represent the company in Argentina; Miguel Khalife with A P Green Chilena Ltds,

SAVE FUEL OIL FOR VICTORY

BY TREATING IT WITH *KIL-SLUDG*

Eliminate sludge conditions in tanks, pipe lines and preheaters with KIL-SLUDG and assure complete combustion of fuel oil.

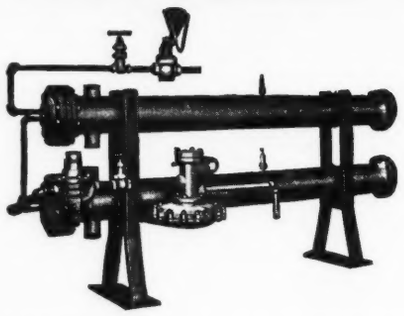
KIL-SLUDG—specially compounded for effective treating of Fuel Oil. One customer reports: We find that it keeps the burner tips and heaters very clean and free from Sludge; in fact, where formerly we were using three heaters, we found we could cut down to two and still maintain our temperature

TRY IT TODAY!

Send trial order at once advising the nature of the sludge problem you want to solve. Ask for further details.

STANDARD CHEMICAL CO.
NATICK, MASS.

HENSZEY



CONTINUOUS BLOWDOWN

The Henszey system continuously and automatically draws off the trouble-making impurities of the boiler water —keeping them well below a predetermined "safe point". Priming, foaming, carryover and (with simple chemical treatment) scale are prevented. This system in operation enables your boilers to produce at maximum capacity for longer periods between shutdowns —enables you to produce the great volume of clean steam needed for war production.

Send for descriptive bulletin.

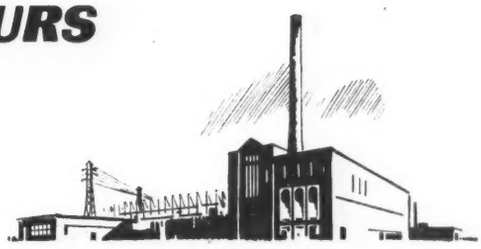
HENSZEY COMPANY
Dept. D10 Watertown, Wis.

GUARD THOSE VALVES OF YOURS

New valves will be *harder* to get—even if you work directly for the war effort.

There are not sufficient materials for valves—or wear resisting parts. Allocation will reduce, still further, amounts valve manufacturers have been able to obtain for lower ratings. And control is directing the uses to which all valves are shipped.

Too few of us have the feel of this war—yet. But, it is our belief that those who need continued operation of valves will be well advised to adopt conservation and substitution right now—as part of the price loyal citizens pay for a victorious war. It is no whit smarter to try to find "angles" by which materials needed for active war can be diverted to our plants than it is for a commander in the field to withhold an order to fire—to save his own hide.



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MANUFACTURERS OF

R CAST STEEL VALVES P&C CO BRASS AND IRON VALVES

D'ESTE ENGINEERING SPECIALTIES

Reading, Pa., Atlanta, Boston, Chicago, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF **AMERICAN CHAIN & CABLE COMPANY, INC.,** BRIDGEPORT, CONNECTICUT

DEPENDABLE!

FIG. 1635

"STANDCO" PILLOW BLOCKS

Ruggedly constructed to insure trouble-free service. Have machined faces and broached babbitted bore. Ample lubrication facilities. Available in a full range of sizes.

FIG. 1432 PATENTED

"HALLOWELL" STEEL SHAFT COLLARS

Precision machined. Fitted with the exclusive "UNBRAKO" Self-Locking Set Screw. Priced right.

Write for complete information.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577

PATCH FLOORS

Roll a drum of INSTANT-USE over to the hole in the floor—remove the lid—shovel out enough to fill the hole—tamp smooth—and open the spot to regular traffic immediately, without waiting. You'll have a tough, solid, permanent patch that formerly took 24 hours to get. This rugged, new plastic bonds tight to old concrete, withstands extreme loads. Keep a drum on hand.

Immediate shipment.

Request Descriptive Folder

MAKE THIS TEST!

FLEXROCK CO.
2377 Manning St., Philadelphia, Pa.

Please send me complete INSTANT-USE information . . . details of FREE TRIAL OFFER —no obligation.

Name .....
Company .....
Address .....

at Casilla 13297, Santiago, Chile, and Benech & Cia. at Cerrito 455, Montivideo, in Uruguay.

W H & L D Betz, Philadelphia, Pa., announce the transfer of Edward C Feddern from their general laboratories to the Department of Research. Mr Feddern, a graduate of Drexel Institute of Technology, has served as a water chemist with the Betz laboratories for the past eight years.

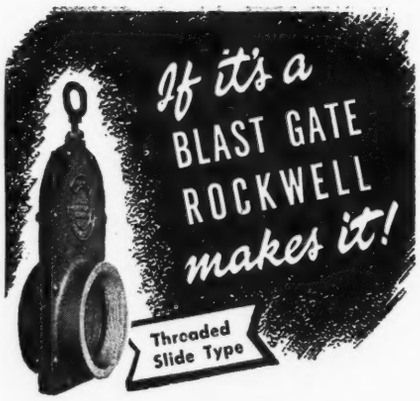
The McClave Co, 751 Mill St, Allentown, Pa., announces the following appointments: Warner E Spencer, 220 Delaware Ave, Buffalo, N. Y., has been appointed manager of sales for western New York State and northwestern Pennsylvania. M C Merrihew, 37 Burnham St, Belmont, Mass., has been made manager of sales for Maine, New Hampshire and eastern Massachusetts. E C Sholler, 1600 Arch St, Philadelphia, is now manager of sales for Delaware and Maryland. C A Warg, formerly chief mechanical engineer of the McClave Co, has resumed his duties as head of the company's engineering department.

Cochrane Corp, Philadelphia, Pa., announces the appointment of the Energy Control Co as flow meter representative for eastern Pennsylvania, southern New Jersey, Delaware and Maryland. Energy Control Co is located at 3107 N Broad St, Philadelphia, and will also handle Hays combustion control and instruments and the Heacon damper.

North American Coal Corp announces the election of A J Ruffini as vice-president in charge of operations of the company. Mr Ruffini, for the past fifteen years, has been general superintendent of the Wheeling Township Coal Mining Co, a subsidiary of the Goodyear Tire & Rubber Co. Frank E Whitaker has also been appointed vice-president and sales manager of the company. Mr Whitaker has been assistant general sales manager of the C Reiss Coal Co for the past six years. Mr Whitaker started his coal career in 1922 as a salesman for Pittsburgh Coal Co in the Cleveland territory.

Water Treatment Co of America, Pittsburgh, Pa., announces the appointment of the Mutual Mfg & Supply Co of Cincinnati, Ohio, as exclusive sales and service representatives in that area. The technical system will also be handled through Mutual's Covington, Kentucky and Norwood, Ohio, branches.

Westinghouse Electric & Mfg Co announces the appointment of G P



ROCKWELL'S complete line of Blast Gates includes all types: Slide, Kwikleen, Wafer, and Butterfly, in sizes up to 48". They are quick and easy to operate—strong, light, and durable. They can be supplied in monel, bronze, stainless steel and other alloys to meet individual requirements.

Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

★ Rockwell ★
BLAST GATES

Better Than
LITHARGE and GLYCERINE for AMMONIA LINES—

- X-Pando Pipe Joint Compound is perfect for use in ammonia lines, brine lines, freon lines and other lines where litharge and glycerine are now used.
- X-Pando makes a joint which is easy to take apart. Yet when X-Pando sets, it ends leaks permanently.
- X-Pando is less expensive than compounds of litharge and glycerine and goes from 4 to 6 times further than other compounds. X-Pando is ready for

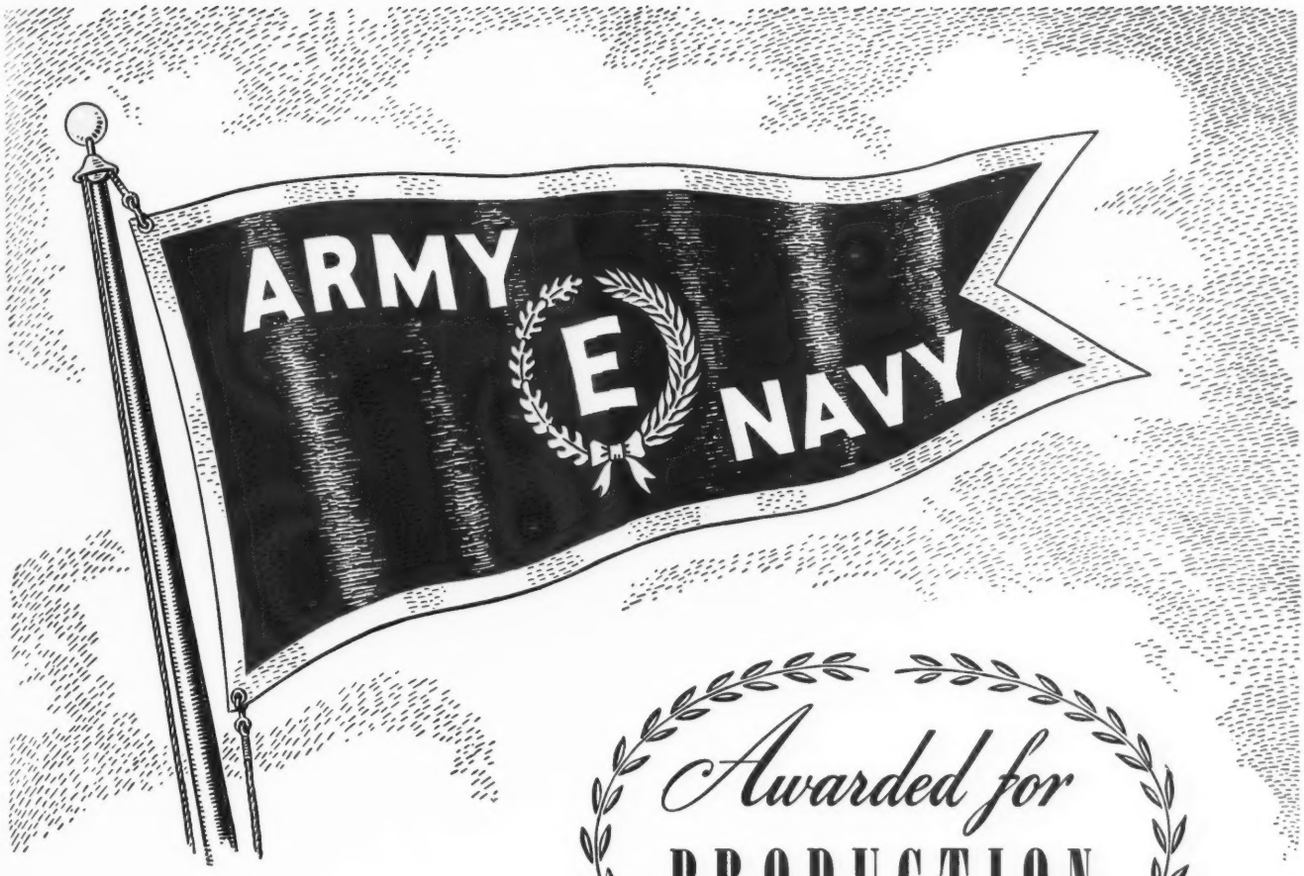
Immediate Delivery

X-PANDO PIPE JOINT COMPOUND

Expands as it sets, one formula for all uses; holds anything carried in metal pipe: withstands high pressure, deflection, high temperature, vibration. Get X-Pando from your local Mill Supply House.

X-PANDO CORPORATION
43-15-36th Street, Long Island City, N. Y.
Stillwell 4-7180

Canadian Distributors: La Salle Products Ltd., 159 Jean Talon St., Montreal, Quebec, Canada



Awarded for
PRODUCTION

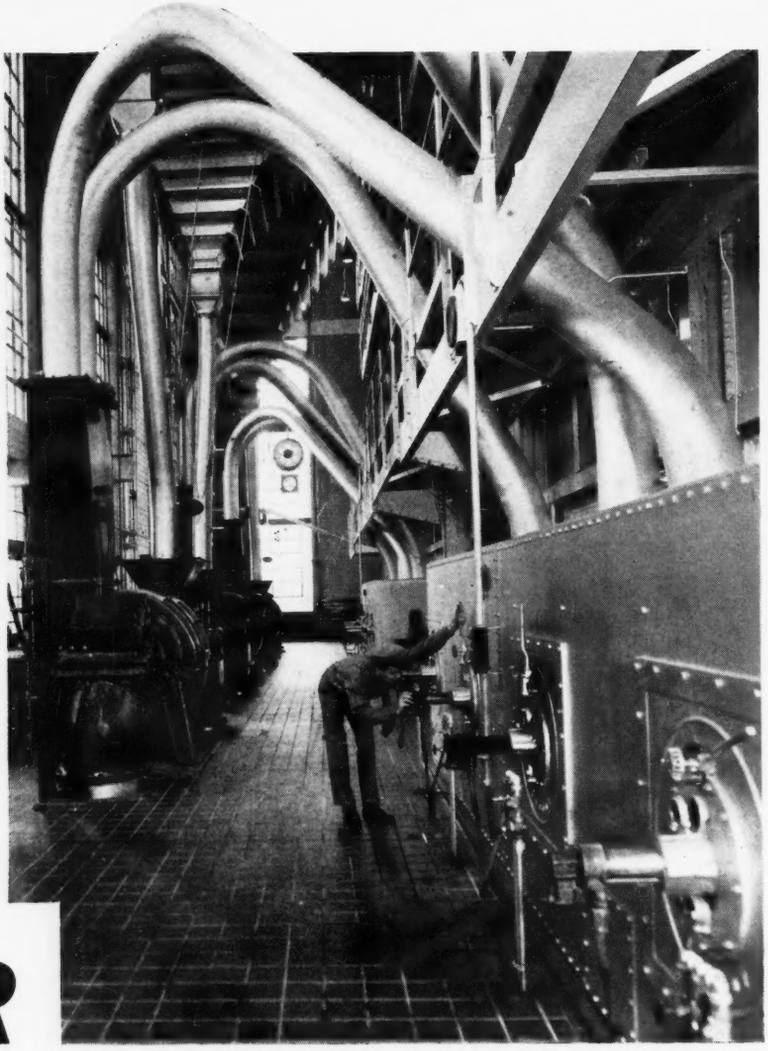
For the second time employees of Foster Wheeler have been awarded the "E" for excellence in production. In war, as in peace, the Dansville plant works to but a single standard. The logical result is this citation for distinguished service in the production of quality, in quantity, on time.

The men and women at both plants—Carteret, N. J., and Dansville, N. Y.—have now received the highest honor that our armed forces can confer in recognition of "all-out" efforts in the call of duty.

FOSTER WHEELER

FOSTER WHEELER CORPORATION • 165 BROADWAY • NEW YORK, N. Y.

Firing aisle in a Michigan Public Utility Plant, equipped with three Foster-Wheeler boilers, fired by 16 Peabody Pulverized Coal Burners. They develop a total of 1,350,000 pounds of steam per hour.



THE RIGHT BURNER

PEABODY BUILDS IT
for Any Fuel and Any Load

For whatever fuel becomes most advantageous—pulverized coal, oil, rich or lean gases—there is a standard type of Peabody Burner that will fire it *properly.*

Complete flexibility in the choice of fuels is obtainable by installing Peabody Combined Burners. Coal, oil and gases may be burned in any combination, simultaneously or individually, through a single burner opening.

Peabody Burners are built for the hard service that is demanded of all boilers.

Send for design details and estimates based on your requirements.

PEABODY ENGINEERING CORPORATION

580 FIFTH AVENUE • NEW YORK

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CLEVELAND		LOS ANGELES		SEATTLE

BUENOS AIRES • MEXICO CITY • MONTREAL

PEABODY LIMITED, LONDON

HERE IS INDUSTRY'S ANSWER — TO THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

"To say the least, the program which your Company has inaugurated towards the objective of conserving power in industry is intriguing and most timely."
Motor Div., General Electric Company

USE WHAT YOU LOSE

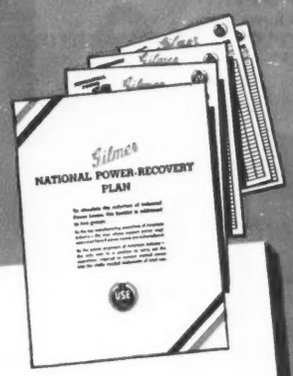
"We extend our congratulations on your National Power-Recovery Plan which is so well explained in the booklet."
Johnson & Johnson

" want to congratulate you upon your 'National Power-Recovery Plan' and its method of presentation "
Leeds & Northrup Company

Typifying the reaction to the Gilmer National Power-Recovery Plan, the above comments give positive proof that Industry is awake to the danger of a power shortage, and recognizes the Plan as a practical stitch-in-time.

Approved by the WPB, the Power-Recovery Plan is offered absolutely free to industry, as Gilmer's contribution to the war effort. The "know-how" of leading power engineers has been incorporated in the Plan, and you'll find a wealth of technical information on each of the power services—Electricity, Steam, Mechanical Transmission, Compressed Air, Water, Refrigeration, Boilers, Prime Movers.

Enlist YOUR plant in this vital battle against power waste. And don't wait until power runs short . . . act NOW. Just send in the coupon, and the Plan will come to you promptly . . . all contained in one convenient booklet.



L. H. GILMER CO., Tacony, Philadelphia, Pa.

Gentlemen:

Please send us, without cost or obligation, a copy of the National Power-Recovery Plan, marked for the attention of:

NAME _____

FIRM _____

ADDRESS _____

Gilmer BELTS

L. H. GILMER COMPANY TACONY, PHILADELPHIA, PA.
The Oldest Firm of Rubber Fabric Belt Specialists

Simplified Shut-Off

Saves Time and Costs Less

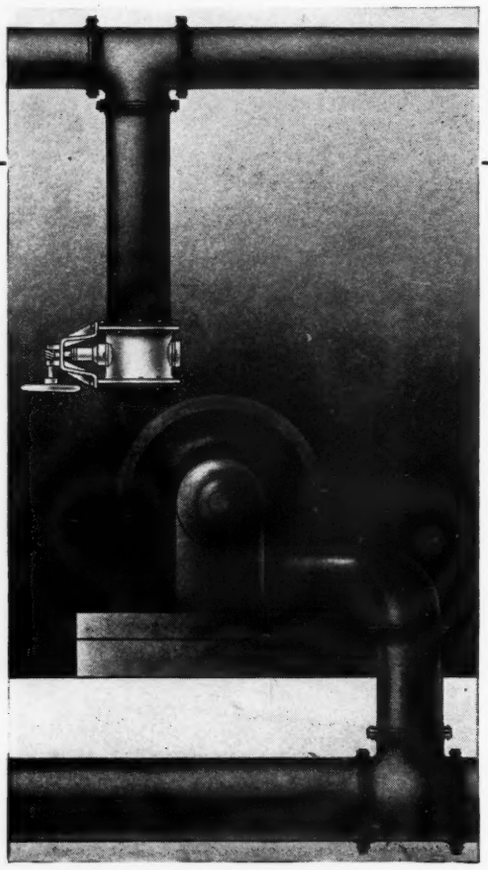
Consider the application of R-S manually operated Butterfly Valves where a battery of synchronous-driven pumps discharges into a common header.

Equipped with handwheel or chainwheel control, the standard 125-lb. valves not only fulfill all requirements to better advantage but cost less to purchase and install than conventional type valves.

Normal procedure when starting a pump is to shut off the discharge valve until the pump has gained the desired speed. The valve is then opened gradually. The operator often neglects to follow this procedure when a conventional type valve is used since the larger sizes require approximately five minutes to close.

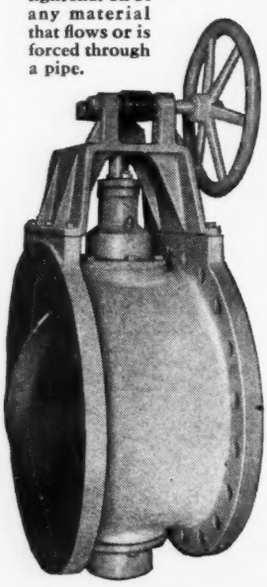
Compare this with the operation of an R-S Butterfly Valve which *requires only six revolutions of the handwheel for complete closure or opening.* It requires only a few seconds of an operator's time and he has no excuse for not performing this important operation before starting a pump when R-S Butterfly Valves are installed.

Burned-out motors at start-ups can be practically eliminated.



Comparatively light in weight, R-S Butterfly Valves effect a considerable saving in installation cost since less space and supporting structure are required. Pressures to 600 pounds and sizes to 84 inches.

The vane closes at the correct angle for the wedge-tight shut-off of any material that flows or is forced through a pipe.



BUTTERFLY VALVE DIVISION

R-S PRODUCTS CORPORATION

4537 Germantown Ave. Philadelphia, Pa.

Write for catalog No. 10-B and detailed information.

R-S Streamlined BUTTERFLY VALVES

Longabaugh to coordinate and direct manufacturing engineering activities of subcontracting war work. In his assignment, Mr Longabaugh will be able to assist the hundreds of outside manufacturers who receive subcontracts. R. E Powers, formerly of Chicago and New York, has been named Pacific Coast district manager of the manufacturing and repair department. Mr Powers goes to Emeryville, Calif., from Chicago, where he served as manager of the manufacturing and repair department of the Westinghouse northwestern district for the past four years. On the Coast he will have charge of all activities of his department in a territory comprising all or parts of eleven western states, Alaska and the Hawaiian Islands.

General Electric Co, Schenectady, N. Y., announces the appointment of W E Silvus to the position of engineer of the Houston local office. Mr Silvus has been with the company's engineering department in the Southwest district since 1926. Charles J Spiegel, General Electric installation engineer, retired July 31, after 43 years of continuous service with the company. He had supervised installations of more than 1,500,000 kw of hydroelectric generators for the company in a number of foreign countries, as well as the United States. Mr Spiegel joined the General Electric Works in the fall of 1899, working in the factory. N B Elliott was appointed manager of sales, unit equipment section. Mr Elliott was graduated from Virginia Polytechnic Institute in 1920, and in July of the same year joined the General Electric Co as a "test" engineer. He was transferred in 1924 to the regulator and capacitor section of the central station department, and in 1926 was sent to Cleveland, Ohio, as transformer specialist for the east central district.

Paul B Huyette Co has been appointed district representative for the Ring Balance Instrument Co, the Ellison Draft Gauge Co, and the Permutit

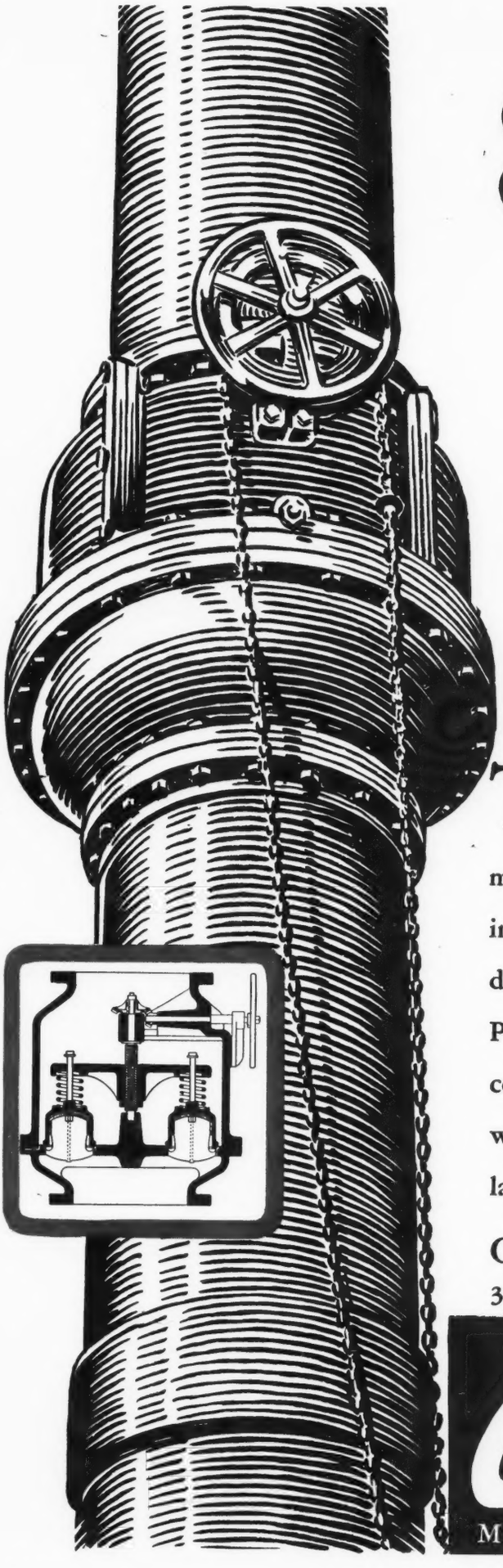
MEETINGS

15th National Exposition of Power and Mechanical Engineering — *Grand Central Palace, New York, N. Y., November 30 to December 5, 1942*

American Society of Mechanical Engineers —*1942 Fall Meeting, October 12–14, 1942, Hotel Sagamore, Rochester, N. Y. 63rd Annual Meeting, November 30–December 4, 1942, Hotel Astor, New York, N. Y.*

American Welding Society—*Annual Meeting, October 12–15, 1942, Hotel Cleveland, Cleveland, Ohio.*

Engineers Society of Western Pennsylvania —*Third Annual Water Conference, November 9–10, 1942, Wm Penn Hotel, Pittsburgh, Pa.*



SAFE!

THE Cochrane Multiport Relief Valve due to its unique and distinctive design, with multiple valve disks (instead of one single disk) insures continuous SAFE operation without danger of sticking, jamming, or freezing. Pressure is readily adjusted by varying the compression of the springs by means of hand wheel, chain wheel, or motor. The most popular relief valve ever built.

COCHRANE CORPORATION
3106 N. 17th Street Philadelphia, Pa.

Cochrane
MULTIPORT RELIEF VALVE

They WEAR themselves into perfect condition

SEA-RO GRAPHITIZED
PUMP PLUNGER RINGS No. 528

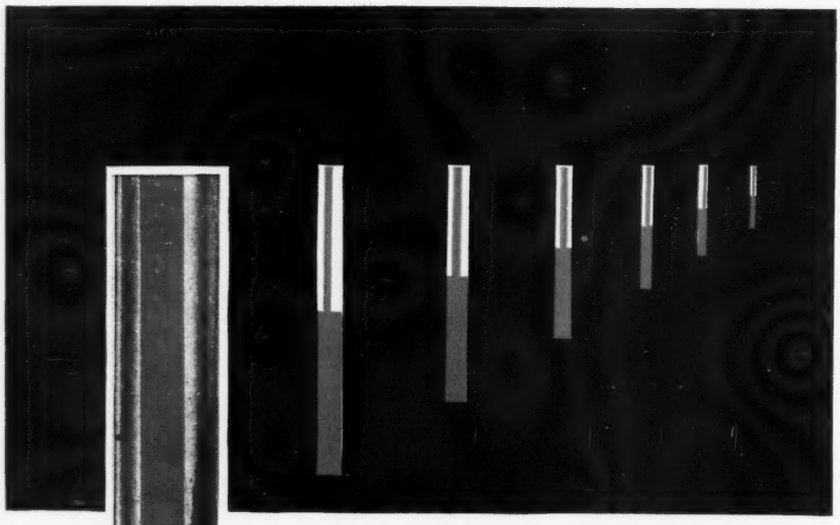
Tests prove that Sea-Ro Graphitized Rings acquire a hard glass-like surface after long operation, and being of a floating type, reduce wear on cylinder liners.

Sea-Ro No. 528 Rings are recommended for plungers of pumps handling hot or cold water, oils, gasoline, solvents, ammonia, etc.

For large heavy-duty, use Sea-Ro No. 525 Rings, with patented internal expansion spring.

Send for detailed information

SEA-RO PACKING CO., INC., WOOD-RIDGE, N. J.



BOILER ROOM SENTRIES
that are always on the job

When you put the water level of your boilers under the protection of PYREX Broad Red Line Gauge Glasses, you choose sentries that never leave their posts.

Line them up the full length of the largest boiler room. The transparent broad red line fused directly to the wall of the gauge glass itself makes the liquid level visible in every glass from any distance.

PYREX Gauge Glasses are backed by brilliant service records, too. They are economical to use because they last longer. Machine drawn accuracy decreases installation strains. Resistance to thermal shock protects them against sudden temperature changes. Their remarkable chemical stability protects their transparency against the corrosive attacks of steam.

PYREX Gauge Glasses are a good investment in permanent protection. Stocked by all leading mill and steam supply dealers.

Left, a reproduction from an actual unretouched color photograph which illustrates the appearance of the gauge glass from directly in front.

"PYREX" *is a registered trade-mark and indicates manufacture by Corning Glass Works, Corning, N. Y.*

CORNING Glass Works Corning, New York

Pyrex Gauge Glasses

Co, Ranarex Division. The Paul B Huyette Co is located at 401 N Broad St, Philadelphia, Pa.

SQUARE D Co, Detroit, manufacturers of electrical equipment, announce the opening of two new branch offices. C T Nash, formerly with the company's New York office, has charge of the new office at 146 Chestnut St, Springfield, Mass., and W W Hendrickson has been transferred from the Charlotte office to open a new office in Greensboro, N. C., located at 303 Kensington Road.

From information received during the past month, POWER *here presents a brief summary of power men who have left their business positions to enter the armed services:*

C B Vick, from industrial sales manager for the Florida Power & Light Co, to lieutenant, U S Navy.

Charles A Thompson, from Pittsburgh office of Robins Conveying Belt Co, Passaic, N. J., to lieutenant, U S Navy.

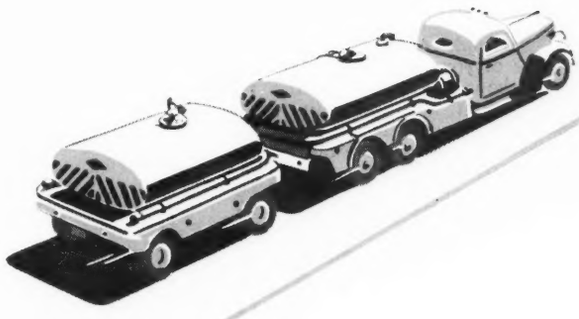
F L Ray, 75, Retires After 48 Years on Duty

Frederick L Ray, mechanical and electrical engineer, resigned Sept 30 as superintendent of the Anderson Sewage Treatment Works, Anderson, Ind. On Nov 28, 1942, Mr Ray celebrated his 75th birthday. Mr Ray has spent 48 years of power plant operation, which began on March 10, 1894.

Mr. Anderson writes: "On Nov 28, 1942, I will be celebrating my 75th birthday, and have just resigned my position effective Sept 30, 1942, as superintendent of the Anderson Sewage Treatment Works. I am getting together all my worldly goods and as soon as I am relieved of my position my good wife and I are going to St Petersburg, Fla, to spend our remaining days in the sunshine and balmy breezes. . . ."

Mr Ray was chief engineer of the Terre Haute Electric Co, Terre Haute, Ind, from March 10, 1894, to April 1,

WHEN BOILER SCALE REDUCES YOUR PLANT EFFICIENCY—



DOWELL CHEMICAL SERVICE

WILL REMOVE THE SCALE *QUICKLY* AND *COMPLETELY*

THROUGH CHEMISTRY has come a better, more effective way of removing scale from heat exchange surfaces. Dowell Incorporated, together with its parent company—The Dow Chemical Company, has developed and perfected a *chemical* method of removing boiler scale, quickly and completely.

This Dowell method is the *fastest, safest* and most *efficient* ever devised for removing water deposited scale from all types of heat exchange surfaces. It does a better job than either mechanical or manual methods and does it in just a few hours where the old-fashioned practices took days. It saves precious time—it keeps vital power equipment operating at peak wartime production.

If you are looking for more boiler capacity and less time off the line—let us give you the complete story about Dowell Chemical Scale Removal Service. Wire, phone or write our general offices in Tulsa—there's no obligation.

Look to DOWELL FOR INDUSTRIAL SCALE REMOVAL SERVICE

DOWELL INCORPORATED
Executive Office:
Midland, Michigan
General Office:
Kennedy Building, Tulsa, Okla.
Subsidiary of
The Dow Chemical Company

BECKMAN pH CONTROL
1. Minimizes Scale
2. Reduces Corrosion
3. Improves Coagulation
4. Conserves Chemicals

Beckman

IS THE *ONLY* pH EQUIPMENT
WITH THIS FEATURE
vital to power plants!

Power plant operators are becoming increasingly aware of the vital importance of accurate pH control for efficient and economical steam generation. By controlling pH they can not only more effectively control calcium deposits, but can also reduce corrosion in valuable plant equipment . . . minimize residual sediment in the feedwater . . . and prevent disintegration of costly zeolite.

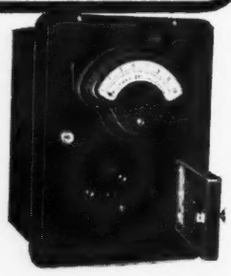
These four-fold savings make possible tremendous economies in boiler plant operation!

BUT REMEMBER THIS: There is only ONE make of pH equipment with which accurate and continuous pH control can be maintained on the hot fluids of boiler plants—*and that make is BECKMAN!*

With the Beckman High Temperature Glass Electrode Assembly you can mount your electrodes *directly in the flow lines* of your plant system. You can measure the pH on the fluids in process without time-wasting and inaccurate "sampling" operations. And best of all, you can Beckman-equip your plant to maintain—*continuously and automatically*—complete control over the pH of the various steps in your feedwater operations, thus securing optimum plant efficiency at all times—*automatically!*

ANOTHER EXCLUSIVE Beckman FEATURE

that is important in boiler plant operations is the Beckman Multiple Electrode Switch. With this device you can maintain a continuous pH record of as many as SIX electrode stations with only ONE Beckman Automatic Indicator. Thus, you can simply mount electrodes in the various critical steps of your feedwater treatment and maintain an automatic check on *all* of them through ONE indicating instrument. Provides 6-station pH recording—*at a great saving in equipment costs!*



THERE IS A SIZE AND TYPE of Beckman pH Equipment for *every* boiler plant requirement. Illustrated is the Beckman Automatic pH Indicator, the most advanced pH instrument available today. Indicates pH *automatically* . . . and will operate ANY standard potentiometric recorder or control instrument for a continuous pH record or complete pH control. Ask for Bulletin 86!

WORLD'S LARGEST MANUFACTURER OF GLASS ELECTRODE pH EQUIPMENT

NATIONAL TECHNICAL LABORATORIES
SOUTH PASADENA, CALIFORNIA

Beckman THE LEADING NAME IN pH

1902. He also saw service at the Kent Avenue Station of the Brooklyn Rapid Transit Co, Brooklyn, N. Y., from June 10, 1907, to Sept 10, 1908. He was employed from Sept 10, 1908, to Feb 16, 1916, as chief engineer for the Louisville Railway Co, Louisville, Ky., in charge of two plants generating power for city and interurban cars. Prior to his joining the Anderson Sewage Works, Mr Ray was chief engineer of the Indiana State Reformatory of Pendleton, Ind., in charge of power generation, steam heating, ice manufacturing, refrigeration, telephone system, lighting and power, sewage treatment works, water treatment plant and many other duties. He fulfilled this position from July 1, 1937, to Feb 22, 1940.

Mr Anderson closes his letter with: "POWER has been a great friend . . ."

The following companies, according to information received this month, have been presented with the Army and Navy "E" Award, for excellence of performance in the fulfillment of naval ordnance contracts:

The Skinner Engine Co. Award presented Aug. 25.

Foster-Wheeler Corp, Carteret and Danville plants. Navy "E" presented May 12 to Carteret plant; Army-Navy Award presented Aug 17 to Danville shop.

Ohio Injector Co. Award presented Aug 26.

S F Bowser & Co, and subsidiary, Fostoria Screw Co. Award announced July 31.

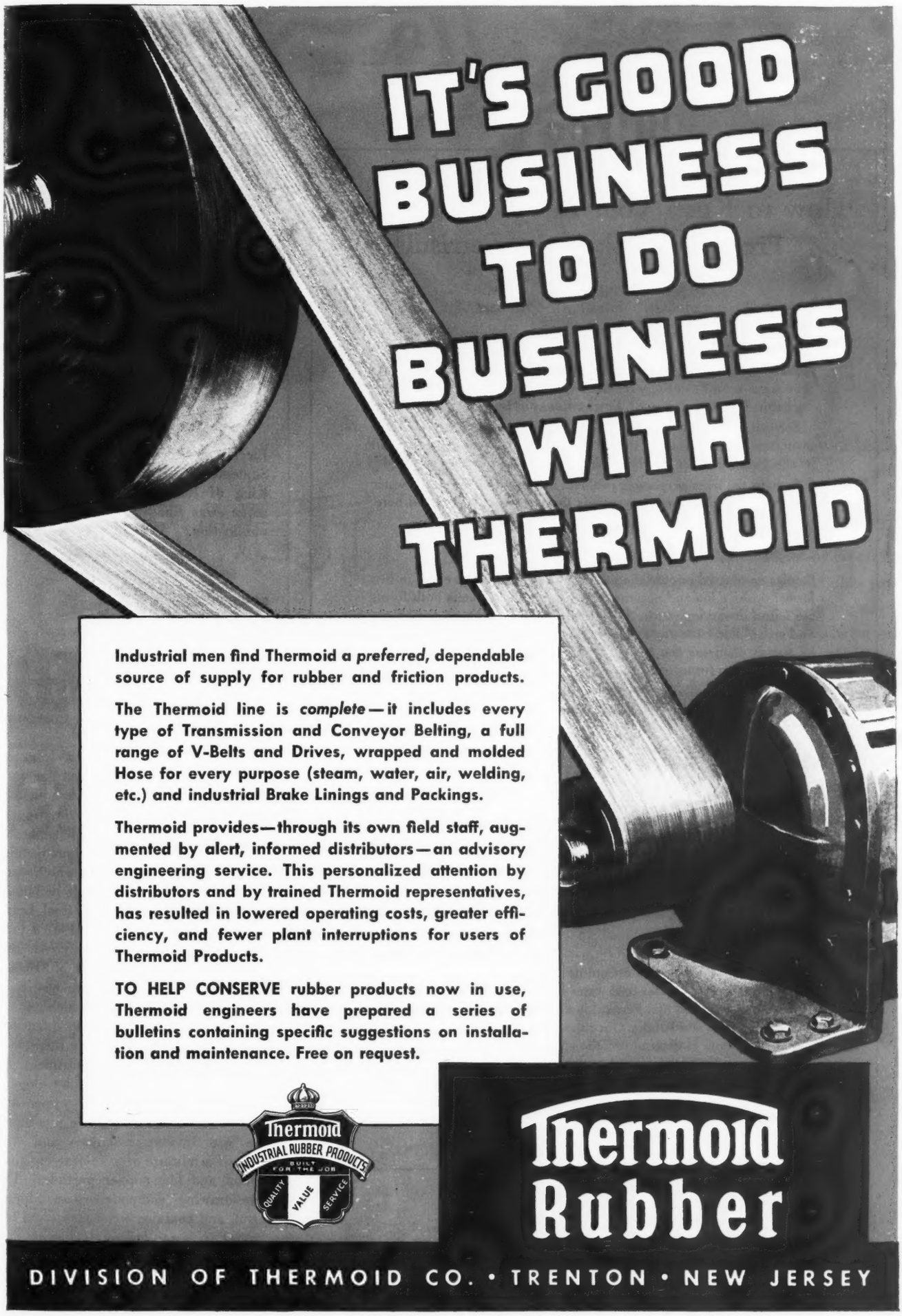
Monsanto Chemical Co.—St. Louis, Monsanto and Anniston plants. Awards presented to three plants simultaneously, Aug 17.

Todd Combustion Equipment, Inc. Award presented Aug 18.

Jenkins Bros. Award made Aug 19.

Leeds & Northrup Co. Award presented Sept 5.

Phelps-Dodge Copper Products Corp,



Industrial men find Thermoid a *preferred*, dependable source of supply for rubber and friction products.

The Thermoid line is *complete*—it includes every type of Transmission and Conveyor Belting, a full range of V-Belts and Drives, wrapped and molded Hose for every purpose (steam, water, air, welding, etc.) and industrial Brake Linings and Packings.

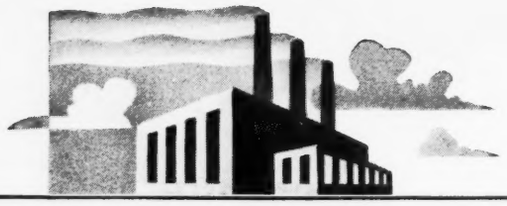
Thermoid provides—through its own field staff, augmented by alert, informed distributors—an advisory engineering service. This personalized attention by distributors and by trained Thermoid representatives, has resulted in lowered operating costs, greater efficiency, and fewer plant interruptions for users of Thermoid Products.

TO HELP CONSERVE rubber products now in use, Thermoid engineers have prepared a series of bulletins containing specific suggestions on installation and maintenance. Free on request.

Thermoid
INDUSTRIAL RUBBER PRODUCTS
BUILT FOR THE JOB
QUALITY VALUE SERVICE

Thermoid Rubber

DIVISION OF THERMOID CO. • TRENTON • NEW JERSEY



How to Keep Your Boiler Feed Water Free from Silica with Ferrisul

By FRANCIS K. BURR, Merrimac Division
MONSANTO CHEMICAL COMPANY

YOU can't afford to take chances on your boiler feed water in a modern high pressure steam generating plant. Organic matter and oily substances must be entirely removed to prevent foaming. Scale forming hardness must be reduced. Total solids must be kept at a minimum.

Ferrisul, anhydrous ferric sulfate, has proved its superiority as a coagulant in all those vital tasks, thanks to its extremely adsorptive floc and its effectiveness under widely varying conditions of alkalinity and pH.

Perhaps the most perplexing problem in conditioning natural water for boiler feed purposes, however, is the removal of silica and here, too, Ferrisul has proved its superiority.

☆ ☆ ☆

Studies conducted in our laboratories indicate that silica exists in two forms: positive ion and negative colloid. In natural waters both forms are found in varying ratios. Since it is possible to change the charge on Ferrisul floc from any degree of positive to any degree of negative by simply changing the pH we have a means of adsorbing or coagulating the two forms of silica.

The negative colloid is easily and economically removed at a pH of about 4.5. The removal of the positive ion silica is more difficult and is best accomplished at pH 9.0.

The quantities of the two forms of silica is arrived at by first determining total silica by the usual gravimetric procedure. Then a sample of the water is coagulated with Ferrisul at pH 4.3 and filtered, removing the negative colloid. By determining the residual silica the amount of the positive ion is evaluated and the negative colloid is represented by the difference in total and positive ion content.

Frequently the dosages of Ferrisul required to remove the positive ion silica are so high that total solids become excessive due to sulfate additions. To eliminate this possibility it is possible to pre-form Ferrisul floc outside the system and wash by decantation prior to addition.

☆ ☆ ☆

Samples and further details on the use of Ferrisul for silica removal and the treatment of boiler feed water in general will be supplied on request. You will find that Ferrisul is dry and free-flowing and therefore easy to store and handle. Once the best treatment for your particular type of water is determined, the application of Ferrisul is simple and requires little supervision. Address your inquiries to: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts.

MONSANTO CHEMICALS

"E" for Excellence—The joint Army-Navy "E" burgee, "representing recognition by both the Army and the Navy of especially meritorious production of war materials," has been awarded to Monsanto and now replaces the Navy "E" first awarded Monsanto December 31, 1941.

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Habirshaw Division. Award presented Aug 12.

Stickle Steam Specialties Co. Award presented Aug 25.

Greenfield Tap & Die Corp. Award presented Aug 19.

American Lava Corp. Award presented Aug 17.

Handy and Harman. Award presented Aug 15.

Leeds & Northrup Co. Award presented Sept 5.

Wellman Engineering Co. Award presented August 13.

Mr King Wrote It

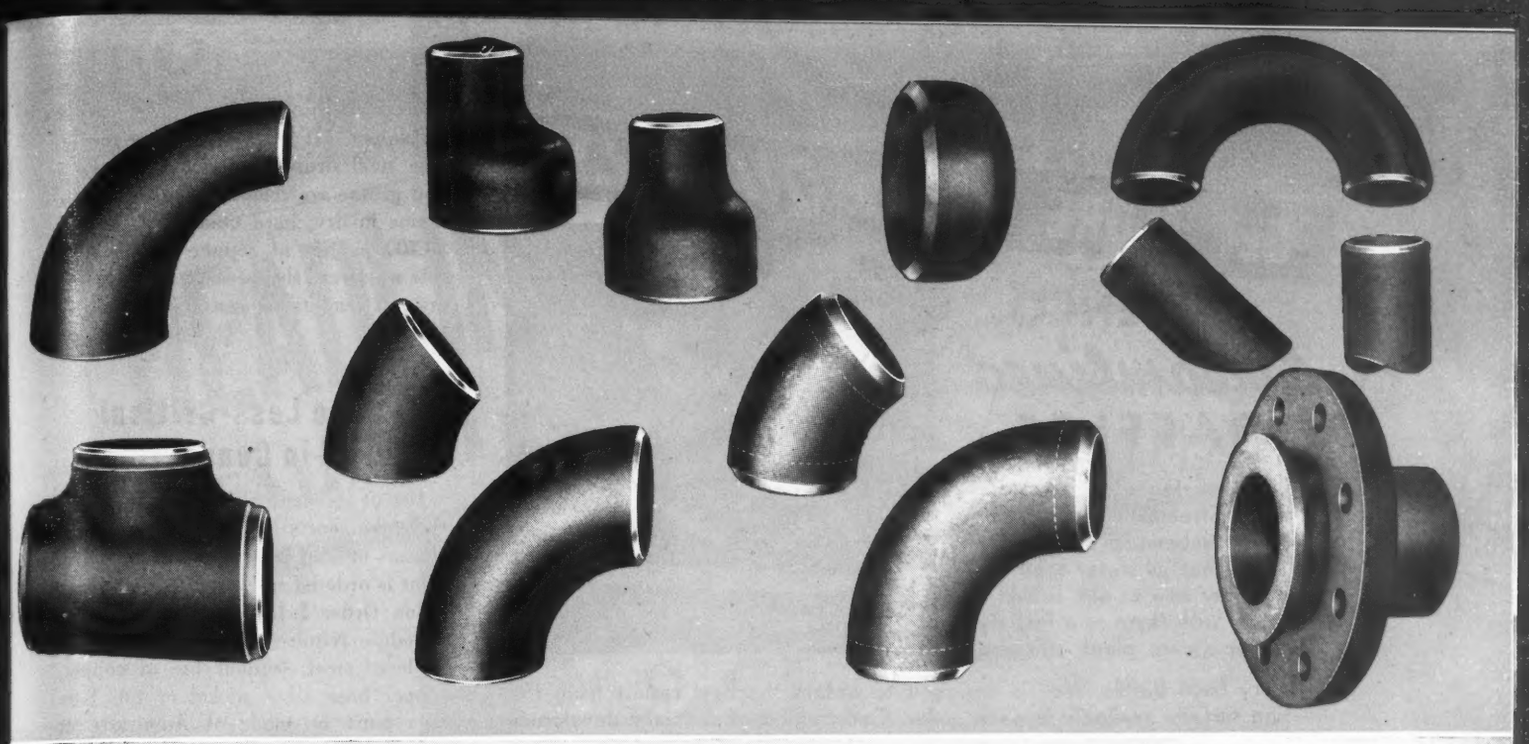
The item "Protect Steam, Water and Electric Sources" on page 102 of the September Clinic was written by H P King of Rochester, New York. The name was inadvertently omitted in publication.

Metals Salvaged From Ashes

Ashes taken from two process-steam boiler pits in the salvage department's shop are yielding critical materials at one of the General Electric Company's major works.

Shop refuse and rubbish from all parts of the Works are used for fuel. Ashes removed from the boiler pits are passed through a ball mill, or grinder; a magnetic separator, which separates the ferrous from the nonferrous metals; and a concentration table which sorts out the finer particles. Metals reclaimed by this method include iron, steel, brass, copper, and aluminum. In 1941 a total of 624,000 pounds was recovered, representing a gross cash return of $10,000.

Other items, which in the past have been unsalvageable economically, are yielding critical materials in quantities that are worthwhile in these times. For example, the salvage department receives from the wire-drawing department a waste known as "copper and grease." It is taken from the pits under the wire-drawing machines and consists of a mixture of wire-drawing compound and fine copper particles. The wire-drawing compound is in liquid form, and contains water, soap and tallow which is applied to the drawing dies for lubrication and cooling. This flows into a pit underneath the wire-drawing machine and carries with it fine pieces



MIDWEST

THE COMPLETE LINE OF Welding Fittings

Many users of welded piping are finding it advantageous to standardize upon Midwest Welding Fittings. Important among the reasons for this preference is the fact that only one source of supply is necessary to meet all their needs. . . . Midwest has the most complete line of welding fittings.

Midwest was the first manufacturer to recognize the need for many of the fittings illustrated here. Reducing Elbows, Saddles, Sleeves, "Long Tangent" Elbows and Shaped Nipples are among the fittings developed by Midwest and first offered to the trade by Midwest.

The design and method of manufacture of Midwest Welding Fittings offer the user definite advantages . . . such as exceptional dimensional accuracy. (See Bulletin WF-41 for details.)

MIDWEST PIPING & SUPPLY CO., Inc.

Main Office: 1450 So. Second St., St. Louis, Mo.
Plants: St. Louis, Passaic (N. J.) and Los Angeles
Sales Offices: Chicago—949 Marquette Bldg. • Houston—229 Shell Bldg.
Los Angeles—520 Anderson St. • New York—(Eastern Division) 30 Church St.
San Francisco—535 Call Bldg. • Tulsa—533 Mayo Bldg.

GET MORE POWER QUICKLY

with ENCO *Streamlined* BAFFLES

THE advantages of Enco Patented Streamlined Cross Flow Baffles have been so definitely established that all water tube boilers, whether new or old, should be equipped with them as a first step to better steam plant efficiency.

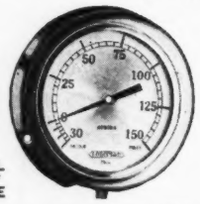
Every Enco Baffle Wall is designed to obtain the best results from the heating surface available in each boiler. Constructed of specially developed materials and installed gas tight by skilled mechanics.

Streamlined to avoid eddy currents and eliminate dead gas pockets that collect soot and fly ash. They save live steam because soot blowers work less often and more effectively.

Write for Bulletin B-40. It tells why Enco Baffle Walls improve the performance of new and old boilers to deliver more steam at lower cost.

THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK, N.Y.

. . . made expressly for use with Ammonia or other brass-affecting liquids



MODEL "SAG" GAUGE

Tubes are made of very high grade steel, carefully tempered, insuring uniformity and reducing to the minimum the chances of spring setting; movement is made of monel, non-corrodible. A perfect example of good engineering and fine craftsmanship, throughout. *Details in the Lonergan Catalog. Ask for it.*

J. E. LONERGAN COMPANY
Race & Second Sts., Philadelphia, Pa.

Lonergan
70th Anniversary
• SINCE 1872 — MAKERS OF PRECISION
VALVES • GAUGES
SPECIALTIES

HERE'S HANDY HELP

for solving technical and business problems

When you want information fast—for dealing with difficult production problems, for settling special managerial questions, or for handling the "1001" situations that arise in every shop, office, laboratory and field—

get the facts—experience—data you need to solve your particular problems from

McGRAW-HILL BOOKS

302-PAGE CATALOGUE

Here is your free guide to practical, expert information on scores of subjects—from Accounting to Zoology. It contains clear, concise descriptions of more than 2000 authoritative, informative books written by leaders in industry, business, engineering and the sciences. For your copy fill in and mail coupon. (Also note on it subjects of special interest on which you desire detailed information.)

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McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y.

Send me a free copy of the 1942 Catalogue of McGraw-Hill Books. I want to know more about:

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of copper. It is shoveled from the pit into steel drums and when the water and grease are removed, the copper remains in dry, hard chunks. Last year 88,200 pounds of copper reclaimed in this way were shipped out to the smelters and vendors for conversion into raw materials.

Must Use Less-Critical Material in Condensers

Use of less-critical material in tubing and tube sheets for steam surface condensers in land power generating equipment is ordered in Schedule II of Limitation Order L-154, effective Aug. 19. Schedule requires that tube sheets be made of steel, without use of copper, copper base alloy, nickel or tin. Tubings must be made of Admiralty or Muntz metal, instead of the more critical cupro-nickel alloy, copper-zinc-aluminum alloy, and cannot be coated with tin. Estimates are that the change in specifications will save 50 tons of nickel, 164 tons of copper, and 9 tons of aluminum annually. The order does not apply to marine condensers. Instructions implementing the recent WPB order have been issued to the priorities staff of the power division by Deputy Chief B J Sickler.

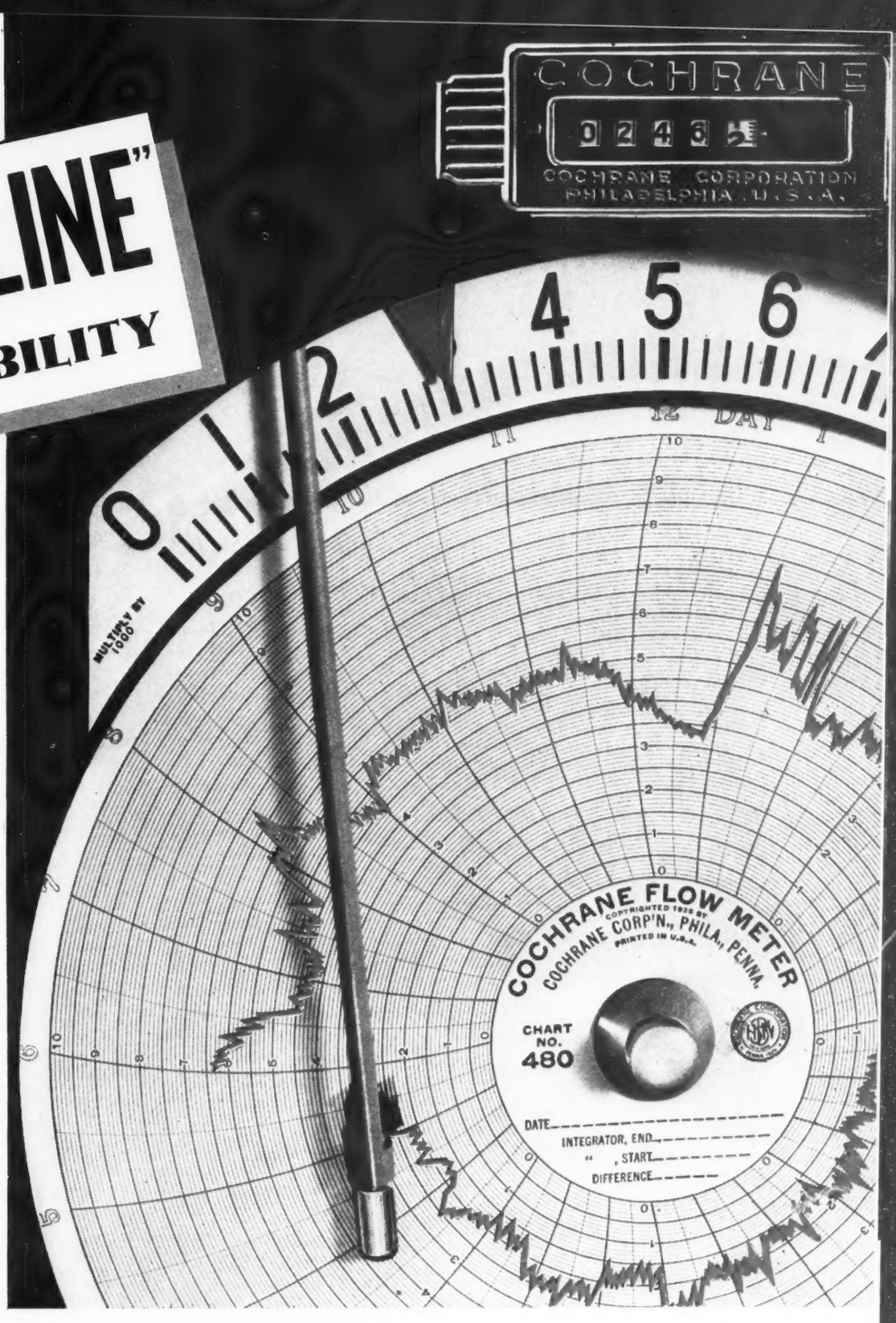
The instructions direct that priorities be granted only for Muntz metal for fresh-water service, and for Admiralty metal for brackish or salt-water service. Where complete retubing is sought, the necessity for this step must be "clearly established," and then only 80% of the original surface (i.e. number of tubes) may be allowed. Replacement tubing also is to be permitted only where it is established that 80% or less of the original surface is serviceable, and the number of replacement tubes permitted is to be limited to 80% of the surface.

Zinc for Publications

A procedure by which the publishing industry can live off its own scrap in the use of zinc has been agreed upon between the War Production Board and representatives of the publishing industry, A I Henderson, Deputy Director General for Industry Operations, announced recently.

A recent WPB order limited the industry to the use of 50% of the amount of zinc they used in the corresponding quarters of 1941. By the agreed new procedure, newspapers and photo-engravers, the big zinc users in the publishing field, can continue to have all the zinc necessary for newspaper pic-

"HEADLINE" READABILITY



Large 10" Indicating Scale—Big Red Pointer—12" Uniformly Graduated Chart—Easy-to-read Integrator

You buy a Flow Meter, as you buy a newspaper, to get the NEWS. You get it quickly from the headlines. Above are shown Cochrane's easy-reading "headlines"—integrator, indicator, pen record on chart. Long-range visibility . . . high readability.

COCHRANE CORPORATION · 3106 N. 17th St. · PHILADELPHIA, PA.

COCHRANE FLOW METERS

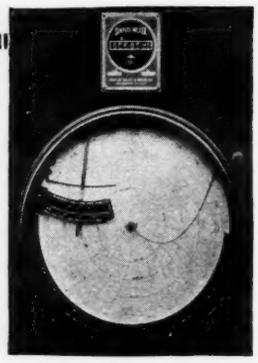
WHAT DOES SIMPLEX

7 DIGIT TOTALIZER

MEAN TO YOUR

FLOW RATE RECORDS?

READ TOTAL FLOW ACCURATELY —ANY TIME!



Clear-cut black figures on white background means easy reading from a distance — the seventh digit makes a great difference, too.

Simplex MS Meters feature a seventh fractional dial on the totalizer which simplifies integrating of flow, and adds weeks of continually increasing daily computations before the counter returns to zero.

What the 7 Dial Counter Means to You

(1) Highest accuracy — continuous friction disc drive is super-sensitive — it reacts immediately to the slightest variation of flow conditions, thus assuring absolute maximum continuous totalizing efficiency.

(2) Read total flow directly at a glance any time.

(3) Only zero is used as multiplying factor.

(4) The seventh fractional digit is a means of closely checking the flow.

The Simplex 7 Digit Totalizer used on Type MS Meters is a precision unit designed to minimize backlash in gearing. It is housed in dust-proof and tamper-proof case. Synchronous electric or Seth Thomas mechanical clock drive is optional.

The Simplex Type MS Meter can be furnished for wall, panel, or floor stand mounting.

For year-round accuracy and ease of totalizing rate of flow be sure it's a Simplex Type MS Meter. Write for our latest descriptive literature.

SIMPLEX VALVE & METER CO.

6780 Upland Street, Phila., Pa.

SIMPLEX

POWER & PROCESS

METERS

THE METER WITH THE BELL SHAPED FLOAT

tures and other engravings without using more than 10 or 15% of the zinc they now consume.

The procedure involves segregation of zinc plates after publication and remelting them for re-use by the industry. Details now are being worked out and will be announced as soon as they are completed.

Careful conservation of zinc is necessary because of a high military demand for the metal, which is used in the manufacture of brass, coupled with difficulties in maintaining present output.

War Effort Theme of Power Show

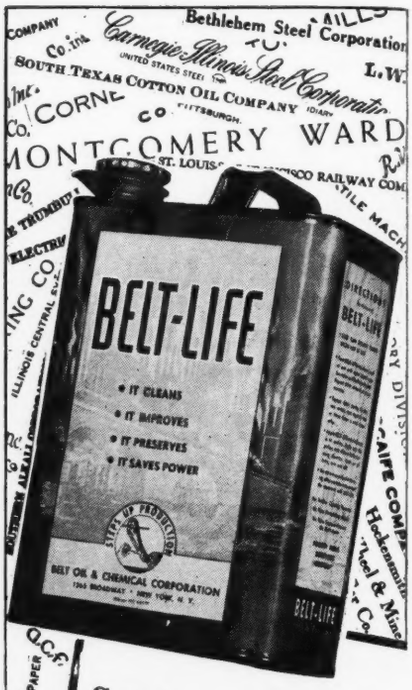
Industry's increasing concentration on the war effort has raised the aim of the 15th National Exposition of Power and Mechanical Engineering, pointing to the common objective of increasing production in plants engaged in war work. The Exposition, better known as the National Power Show, is to be held in New York City November 30 to December 5, and already more than 150 exhibitors have taken space, while there is an increase of interest on the part of other manufacturers in making reservations.

All the problems that are geared to power as the mainspring of industry funnel down through the group of exhibitors, whose leaders have been represented at the National Power Shows for the last twenty years. This year the aspect of the Exposition is changed by the need for more power and for using power more efficiently than ever before—but on production problems that are relatively new.

Exhibitors, contributing to the war effort, are devoting their plans for the Exposition to points involving service to industry. Introduction of new lines of machines and equipment have even been suspended in many instances in order to aid in finding new and better ways of doing things, when the best that can be done is to "regrind, weld, repair and conserve".

As heretofore, the power theme will dominate the Exposition. The range of exhibits includes such items as refractories, coal and ash handling equipment, dust collectors, insulation, combustion controls, indicating and recording instruments for the power house, boiler tubes, pumping, piping, all types of valves, steam traps, steam specialties of many kinds and a variety of power plant supplies.

The 15th National Exposition of



Serving America's Leading Industries

BELT-LIFE

STEPS UP PRODUCTION by transmitting full power from motors to machines

ACTUAL TESTS demonstrate that BELT-LIFE raises efficiency of machines 50 to 95 percent. For every kind of belt;—leather, rubber, camel's hair, hemp, etc., and on all types and shapes;—flat, round, wedge, etc. Product of BELT OIL & CHEM. CO.

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American Car & Foundry Co.
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The Globe Steel Abrasive Co.
Trumbull Electric Mfg. Co.
and many others

FREE OFFER Try BELT LIFE one month. You will find there is no other belt dressing that compares with BELT LIFE. If not fully convinced, return unused portion at our expense.

NO OBLIGATION—MAIL COUPON TODAY

TIMES APPLIANCE CO.
353 Fourth Ave., New York, N. Y.

You may send the FREE TRIAL GALLON OF BELT-LIFE. We will give it a fair test. If, in our opinion, it is not completely superior to what we have been using, we will return the balance at your expense. Otherwise we will send you a check for $8.70.

Name .....

Address .....

City ..... State .....

FOR a good many years we have talked about how Jones speed reducers, gears and other transmission products have been built for long trouble-free service. Some people might have said that we placed too much emphasis on ruggedness, stamina and the ability of our products to "stand up and take it".

But today in every phase of war work, industry is calling for products that will measure up to these standards by continuously staying on the job.

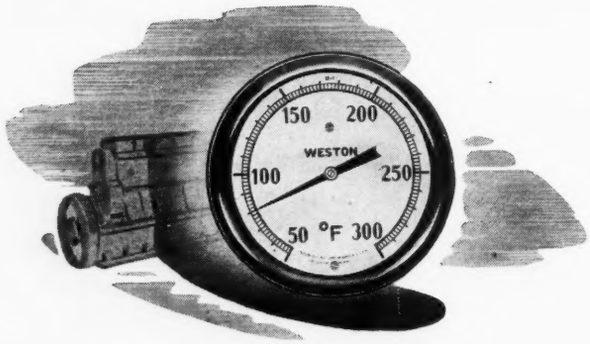
Our Bulletin No. 80 "Jones Drives for Industry" will give you a complete outline of the range of Jones speed reducers, gears and other transmission products that are built to stand the 24-hour a day drive for victory. We shall be glad to mail you a copy.

W. A. JONES FOUNDRY & MACHINE CO., 4423 Roosevelt Road, Chicago, Illinois

Jones

HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS • PULLEYS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

THE ALL-METAL THERMOMETER

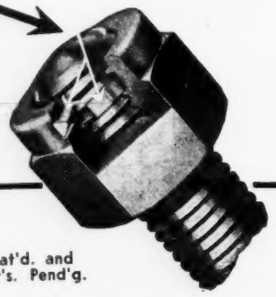


stands shaking up...without breaking down

The reason why the WESTON Thermometer can "take it" is found in its simplified, all-metal construction. There is but one moving element, and even that part is made of enduring metal. There is no gas or liquids . . . no capillary . . . no fragile members. Thus the WESTON not only resists ordinary breakage but it also stands up in applications where vibration is present . . . maintaining its high initial accuracy (within 1% over entire scale) over far longer periods. Available in types, sizes, ranges and stem lengths for Diesel and many industrial applications. Descriptive literature available on request. Weston Electrical Instrument Corporation, 679 Frelinghuysen Avenue, Newark, N. J.

WESTON *ALL-METAL* **TEMPERATURE GUAGES**

THIS LOCKING RING DEFIES VIBRATION!



Pat'd. and Pat's. Pend'g.

Works like a brake band

The locking ring works on the principle of a brake band and positively prevents loosening of the nut.

REG. U. S. PAT. OFF.

UNSHAKO

The nut is entirely *self-contained*. It is applied just like any ordinary nut. Can be backed off with a wrench and re-used. Write for more details today.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 577

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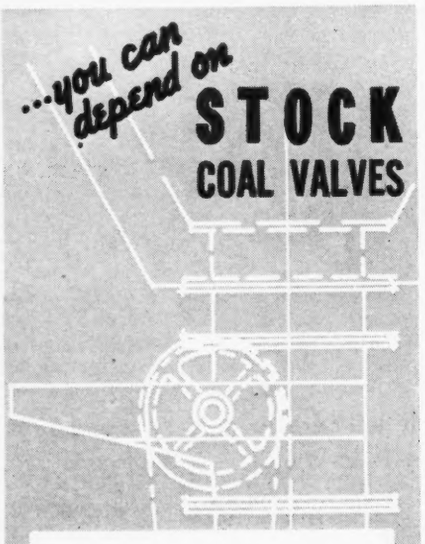
...you can depend on

STOCK COAL VALVES



Sturdy dependability and maintenance—free operation . . . *that's what you get with STOCK Coal Valves.* Designed and built to highest quality standards, these items are an important cog in STOCK's complete "BUNKER-TO-STOKER & BUNKER - TO - PULVERIZER" coal supply systems. Detailed drawings covering the complete STOCK line . . . Scales, Distributors, Valves, Downspouting, Collars, etc. . . . are available—write for them!

STOCK ENGINEERING COMPANY
1983 THEODORE AVE. • CLEVELAND, OHIO

Power and Mechanical Engineering, like its predecessors in the biennial series, will be under the management of the International Exposition Company, whose headquarters are at Grand Central Palace, New York. Charles F Roth is manager of the Exposition, and E K Stevens associate manager.

William R Shiperly Dies

William R Shiperly, head of the field service work of the Chaplin-Fulton Manufacturing Company, died at his home in Pittsburgh, Pa., August 9, after an illness of several months. He had been with the Chaplin-Fulton Company continuously since 1918, when he entered its employ as a machinist, and had served in various capacities. He had charge of the testing laboratories of the company before he undertook the field work through which he became most widely known. Apart from his practical contacts with operating men on the staffs of utility companies and of industrial users of pressure control equipment, attendance at conventions and the conduct of special classes under both educational and business auspices had made him a wide circle of friends.

National Safety Congress in Chicago, Oct 27-29

Save manpower for warpower!

That is the theme of the 31st National Safety Congress and Exposition, to be held in Chicago October 27-29.

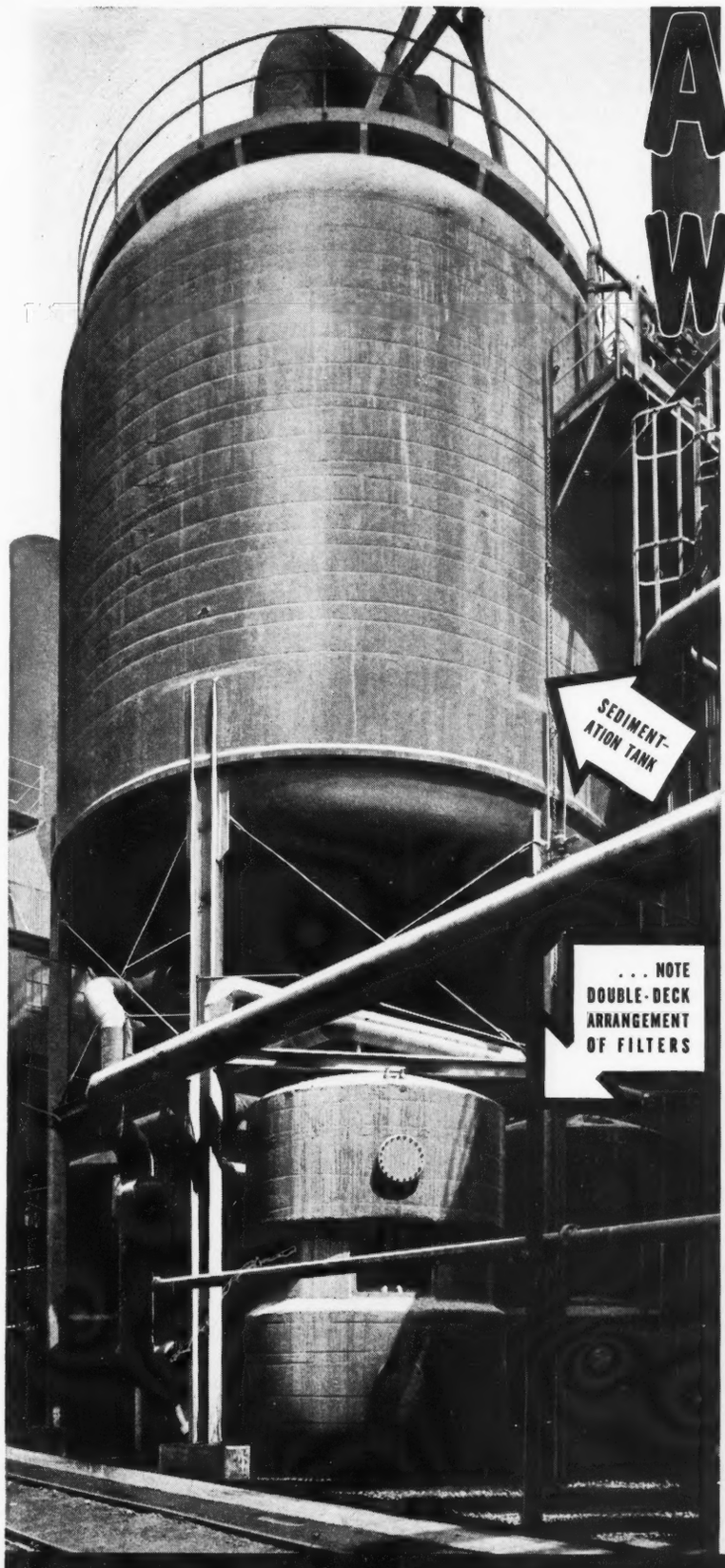
The first wartime Congress since 1918 will be devoted completely, the Council said, to the safety job now at hand—to help win the war.

The entire Congress program, covering every phase of safety with 175 sessions and 500 program participants, will be centered on the problem of stopping accidents that delay victory by slowing production, impeding the movement of troops and supplies, and wasting manpower, material and time.

The Congress is the annual convention of the National Safety Council. It is the largest safety event in the world. Attendance averages 10,000, and safety leaders from all parts of the country assemble to exchange ideas, experiences and problems. Delegates this year will work overtime to cram the program into three days, instead of the usual five, and thus avoid week-end travel.

The 1942 Congress comes in the midst of a nationwide war emergency safety campaign being conducted by the Council at the first request of President Roosevelt.

To provide the Council with sufficient



A BIG JOB of Water Softening

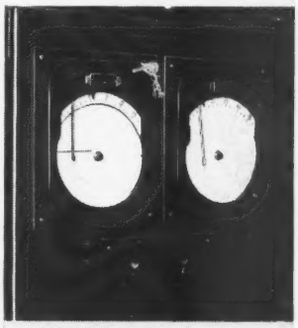
100,000 GALLONS PER HOUR COCHRANE DEAERATING HOT PROCESS SOFTENER AT PITTSBURGH PLATE GLASS COMPANY

AT THE BARBERTON, Ohio, plant of the Pittsburgh Plate Glass Company, is installed the largest deaerating hot process softener in the world—a Cochrane unit, of 100,000 gallons per hour capacity.

Heating and deaeration of raw and treated water are accomplished by external jet heaters and atomizers, while the condensate (18,000 GPH) is deaerated with a separate tray-type deaerator.

Lime and soda ash are used as reagents and are mixed in separate tanks, double-decked to conserve space. Reagents are proportioned to the sedimentation tank by means of proportioners electrically controlled by Cochrane Flow Meters.

Like the chemical mixing tanks, the eight 11 ft. vertical filters are also double-decked as shown. Interesting facts about modern water softening are contained in Cochrane Publication No. 3000. Write for a copy.



Cochrane Electric Flow Meters control proportioning of chemicals to sedimentation tank

COCHRANE CORPORATION
3106 N. 17th Street • Philadelphia, Pa.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

FYR-FEEDER

MULTIPLE SPREADER STOKERS

BURN COAL LIKE OIL!

American Coal Burner Company
18 East Erie St., Chicago, Ill.

Gentlemen:-

I wish to take this opportunity of congratulating you upon the excellent stoker which you have furnished us. We have used your stoker continually for about six weeks, namely, during the time we were putting up our pea pack. This is the time of the year when the greatest stress is put upon men and machinery and I must say that your stoker came through with flying colors.

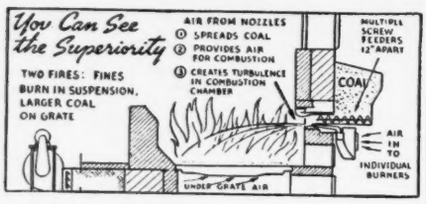
Never before have we had such even steam pressure and such a maximum amount of driving power. Your FYR-FEEDER burns up the coal most uniformly, thereby getting the utmost heat out of the fuel, and leaving very little waste.

Needless to say, this has resulted in a saving for us both in labor and fuel, and at the same time increasing the output which we were so much in need of. I would not hesitate to recommend this stoker to my best friend.

Sincerely yours,
(Large Packing Plant)

Name on request

Act now to protect yourself against FUEL SHORTAGE, steam shortage and manpower shortage in the critical days that lie ahead. WRITE NOW for full details on FYR-FEEDERS.


You Can See the Superiority
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE
AIR FROM NOZZLES
① SPREADS COAL
② PROVIDES AIR FOR COMBUSTION
③ CREATES TURBULENCE IN COMBUSTION CHAMBER
MULTIPLE SCREW FEEDERS 12" APART
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

MULTIPLE BURNER SPREADERS ARE ADVANTAGEOUS AND NECESSARY
Each FYR-FEEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates, impossible to secure with a single spreader.

AMERICAN COAL BURNER CO.

ENGINEERS, Est. 1918

32-18 East Erie Street, Chicago, Ill.

funds to carry on the greatly expanded program urged by the President, industrial and business leaders of the nation have formed the War Production Fund to Conserve Manpower, under the chairmanship of William A Irvin, former president of U. S. Steel.

Headquarters for the Congress will be the Hotel Sherman in Chicago, but sessions also will be held in the Morrison and LaSalle hotels.

Alfred Schoellkopf Dies

Alfred H Schoellkopf, president of Niagara Hudson Power Corporation, died September 9 after several months' illness. He was 49 years old.

Mr. Schoellkopf, regarded as one of the outstanding public utility leaders of the country, has been president of Niagara Hudson Power Corporation since 1933, and previously had been president of Buffalo, Niagara and Eastern Power Corporation since 1929. He has been associated with the Niagara Hudson System and its predecessor companies for the past 27 years.

Mr. Schoellkopf was chairman of the New York State Board of Social Welfare and president of the Welfare Council of New York City, and was formerly chairman of the New York State Temporary Emergency Relief Administration, having succeeded Harry L Hopkins in that position when Mr Hopkins became Federal Emergency Relief Administrator.

Born in Buffalo, July 12, 1893, Mr Schoellkopf was the son of C P Hugo Schoellkopf and Emily Annette Schoellkopf. He was the grandson of Jacob F Schoellkopf, pioneer of hydro-electric power development at Niagara Falls.

Mr Schoellkopf attended Lafayette High School in Buffalo, Phillips Academy at Andover, Massachusetts, and Massachusetts Institute of Technology.

He was first employed by The Niagara Falls Hydraulic Power and Manufacturing Company in 1915 and became vice president and director of The Niagara Falls Power Company in 1920. When Buffalo, Niagara and Eastern Power Corporation was formed in 1925, he became a director and vice president of that corporation, serving as its general manager until 1929. From 1929 to 1933 he was president of Buffalo, Niagara and Eastern Power Corporation, resigning in September 1933 to become president of Niagara Hudson Power Corporation.

Mr Schoellkopf was also chairman of the board of Niagara Sprayer & Chemical Company, Inc, chairman of the

GUARD AGAINST LOSSES *in production time*

Avoid delays by using a Castable Refractory, made with LUMNITE, for refractory maintenance

HERE'S a way to reduce boiler "time-outs" and lost horsepower hours! For your refractory maintenance and replacements specify and use Castable Refractories made with LUMNITE.

If you need a new door lining . . . a cast-in-place baffle or wall patch, or a special refractory shape *in a hurry,* here's all you do. Get a Castable Refractory (a dry mixture of refractory aggregates and LUMNITE). Add water to the mixture, right on the job . . . pour it in a simple form. It quickly gains high cold-strength and is ready for service in 24 hours. No waiting . . . no delay . . . no production time out.

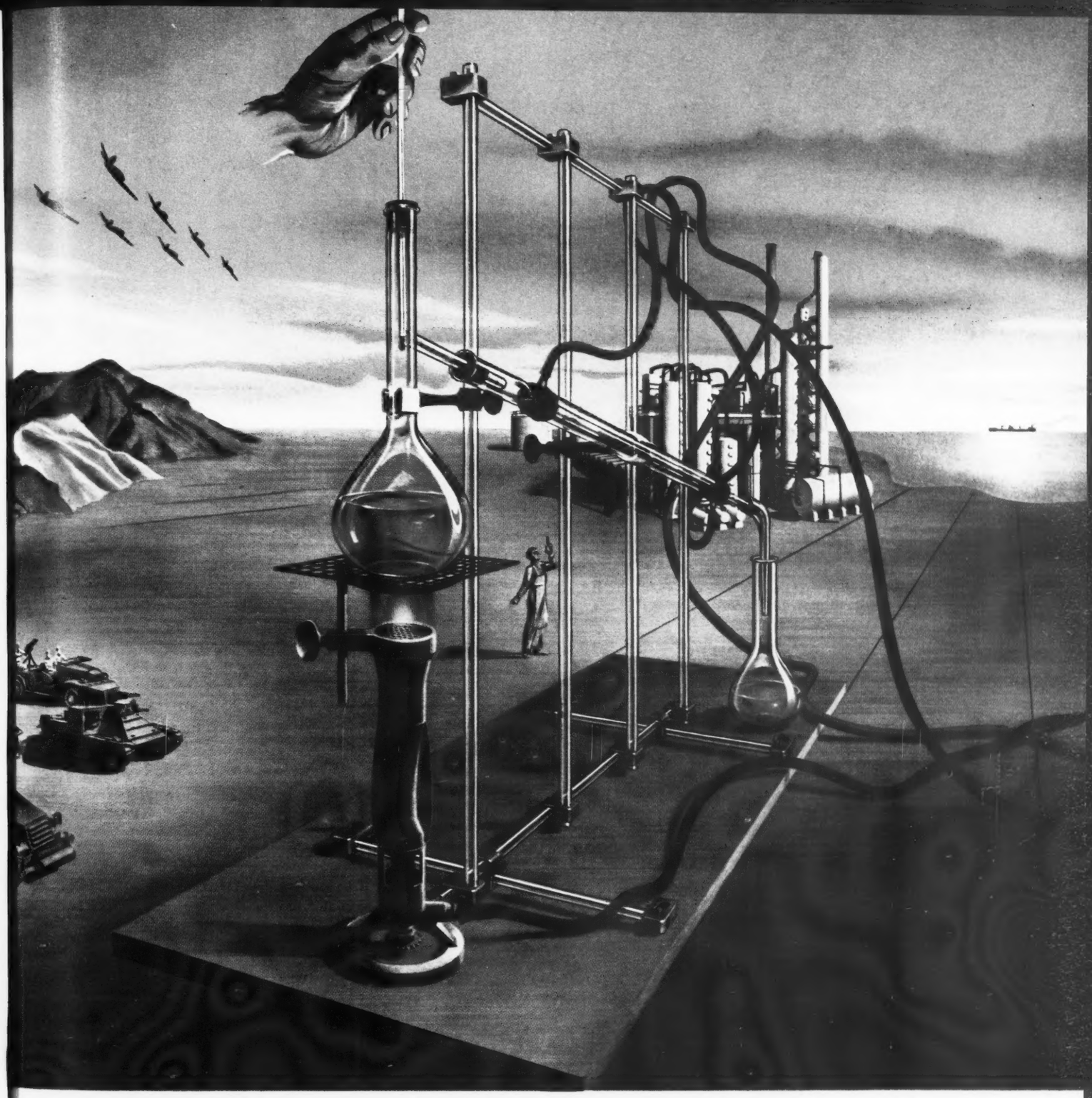
Castable Refractories are as easy to handle as ordinary concrete. There's no cutting or fitting . . . no ramming . . . practically no shrinkage in drying or firing. They're not affected by steam or moisture. Have high resistance to spalling. Upkeep costs are low.

Specify Castable Refractories made with LUMNITE. and you get a balanced, always uniform product, made with carefully selected aggregates and the hydraulic binder which made Castable Refractories possible.

Castables to meet different temperature and insulation needs are made by refractory manufacturers and sold by their distributors. They should be used according to the manufacturer's direction.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Building, N. Y. C.

Specify **CASTABLE REFRACTORIES MADE WITH LUMNITE**



Chemistry is putting miracles on a mass production basis

If ever a "secret weapon" does emerge from all this welter of war, it will most likely be a chemical development. And the American chemical industry has as good a chance of discovering it as any other, for America now has the greatest synthetic organic chemical industry in the world.

This industry looks to coal tar chemicals for almost half the raw materials it uses. Koppers is at the very roots of these chemicals.

Koppers toluene goes into TNT, the principal military bursting charge. Koppers benzene is used in the manufacture of explosive stabilizers, and "boosters" for primers. Koppers naphthalene helps minimize the flash in powders.

Most explosives are made using combinations of nitric and sulfuric acids. Koppers coke ovens produce ammonia and this helps meet the extraordinary demand for fixed nitrogen and increases the amount of nitric acid available for the war effort.

The Koppers Phenolate Process helps the petroleum and the coking industries recover more sulfur which is converted into sulfuric acid.

Koppers tar acids and naphthalene find use in synthetic plastics for airplanes, tanks, etc.; naphthalene is used in chemicals for synthetic and natural rubber. Pyridine is an ingredient in the new process for waterproofing military fabrics for jeep tops, tents, etc. Flotation sulfur is one of the principal spray materials for fruit crops.

Koppers serves the chemical industry in peace as well as war. Of the hundreds of coal tar intermediates, dyes and medicinals, about 87% are produced in greater or less degree from benzene, toluene, naphthalene, and phenol. Koppers is one of the principal sources of these and other basic materials. —Koppers Company, Pittsburgh, Pa.

Buy United States
War Bonds and Stamps

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

Workers in our Bartlett Hayward Division are now privileged to wear the Navy "E" emblem

HOW TO GET A NEW PLANT IN OPERATION OR AN OLD ONE BACK INTO SERVICE

in a Hurry!

Use Republic ELECTRUNITE Boiler Tubes!

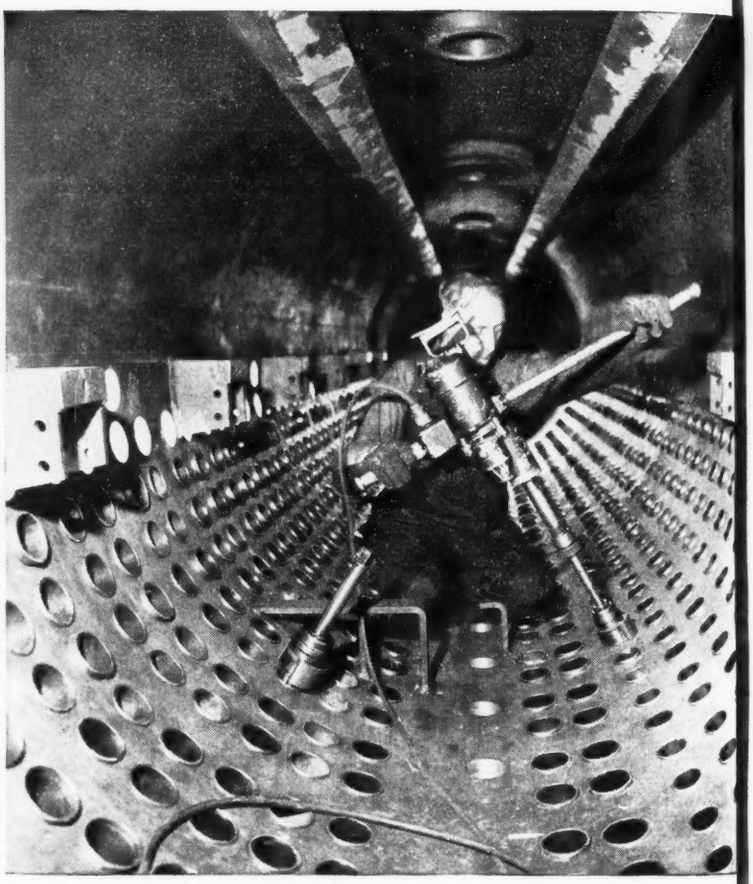
The inherent advantages of these electric resistance welded tubes shift tubing and re-tubing jobs into high gear—cut "down-time" —permit boilers to go into operation sooner.

ELECTRUNITE Tubes have a consistent uniformity of diameter, wall thickness, roundness and ductility not found in tubes made by other processes—because they're made from flat-rolled steel and electric resistance welded.

To the man who wants real speed in tubing installation, these qualities mean free and easy sliding of tubes through holes in tube sheets or drums—fast, sure roller expanding to tight, non-leaking joints—clean, smooth beading over—sound, strong welds. An idea of the speed obtained can be obtained from reports of savings in installation by users—up to 30%.

And once installed, ELECTRUNITE Tubes will render long trouble-free service. Their high strength is proved by hydrostatic testing within 20% of the minimum yield point of the steel. Their smooth, scale-free surface does not invite corrosion.

Write us for further details—and if you expect the need of tubes in the near future, give us or your nearest ELECTRUNITE Distributor full



information on your requirements at the earliest possible date. You'll save time when time will count most.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
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ELECTRUNITE

Reg. U. S. Pat. Off.

REPUBLIC STEEL PRODUCTION FOR VICTORY

ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

PRITCHARD

Design, Engineering and Construction Services:

NATURAL GAS	Compressor Stations Dehydration Plants
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STEEL	Plant Piping and Construction Dry Blast for Blast Furnaces
SYNTHETIC RUBBER	Plant Piping and Construction Dryers and Special Equipment
CHEMICAL	Plant Piping and Construction. Drying ... Heat Exchange ... Cooling Equipment

Also Cycling-Extraction Plants ... Steam, Diesel and Gas Engine Power Plants ... Propane-Butane Standby Fuel Systems ... Cooling Towers ... Heat Exchangers ... Gas Cleaners

This company designs and constructs "facilities for production" in many fields. Today there are few industries with expansion problems that we cannot serve ... somewhere ... somehow.

Designing · Engineering · Purchasing · Construction · Supervision

J·F·P&CO· *Services*

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FIDELITY BLDG. KANSAS CITY, MO.

BRANCH OFFICES IN TULSA, OKLA. HOUSTON, TEXAS
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Furnace linings last much longer!

Because joints laid up with ADAMANT Fire Brick Cement are literally "as strong as the bricks they bond", such furnace linings last *much longer*. The time between shutdowns for relining is *greatly lengthened*.

ADAMANT
FIRE BRICK CEMENT

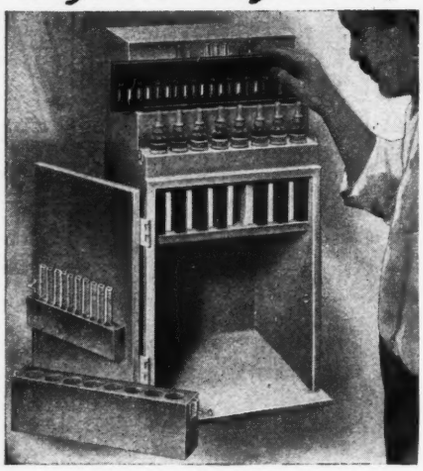
Impartial laboratory tests show an average modulus for ADAMANT of 800 lbs. per sq. in. at room temperature . . . 1270 lbs. per sq. in. at 2600°F. ADAMANT comes ready-mixed—is easy to apply. Let us send you full details.

Adamant has a P.C.E. of over 3000°F.

BOTFIELD
REFRACTORIES COMPANY

786 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

Now...
MAKE pH DETERMINATIONS
anytime.. anywhere!



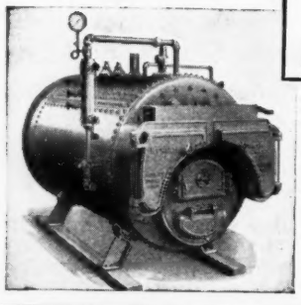
The Taylor Dalite pH Slide Comparator permits speedy, dependable boiler water control. Dalite glass gives uniform lighting day or night. Comparator base, 3 to 8 color standard slides for pH, phosphate, etc., vials of indicator solutions, pipettes and test tubes . . . all fit into 12" x 12" x 21" wooden case. All Taylor Color Standards carry AN UNLIMITED GUARANTEE AGAINST FADING.

See your dealer or write direct.

W. A. TAYLOR AND CO.
YORK & ROGERS FORGE RDS. • BALTO, MD.

KEWANEE
SCOTTIE JR BOILER

HIGH PRESSURE STEAM AT LOW COST



● *5 sizes* . . . conveniently compact yet easily accessible. Economical to buy . . . economical to operate. Easy payments in accordance with U.S. Government regulations thru our Finance Corporation.

For 6" rule with scale for reading pipe sizes, write Dept. 99-KX.

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

BETTER SERVICE — SAFETY — SATISFACTION
FOR REPLACEMENTS ORDER

Mica Shields Protectors

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

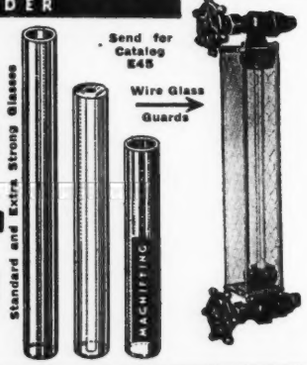
Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



Send for Catalog E45

Wire Glass Guards

ERNST WATER COLUMN & GAGE CO.
RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

board of New York Power and Light Corporation and a director of other Niagara Hudson System companies.

Norfolk Dam Powerhouse

A contract for construction for a powerhouse "shell" at Norfolk Dam to cost "more than $1,000,000," was awarded today by the Little Rock District U S Engineers to two Western companies who already have other dam contracts.

The companies, Utah Construction Company, San Francisco, Cal., and Morrison-Knudsen Company, Boise, Ida., will construct outside housing for a power installation at the river project.

A contract amounting to less than $500,000 was awarded to Joseph J Duffy Company, Chicago, for construction of an expansion unit of a Camp Robinson sewage disposal plant.

Crew Repairs Furnace Without Shutdown

Working next to tons of molten slag at the base of the largest electric furnace in the world, the men of the mechanical crew of Monsanto Chemical Company's phosphorus plant turned a threatened break-down into a brilliant production victory.

When the big furnace developed a break the men in the plant volunteered to make repairs while the unit was in operation, the first time a job of this magnitude was ever attempted, and the success of the job insured the continued record-breaking flow of vital elemental phosphorus to war uses.

Working in terrific heat under the constant threat of tons of white-hot slag cascading from the plugged tap-hole, the mechanical crew and tap men fixed the cooling jacket and put the furnace back in perfect shape without losing an hour's production time. The job, of course, was carefully considered and supervised, for any hasty action around that tap-hole would be like walking into a volcano and dumping a one-ton bomb into the crater. The slightest mistake would have brought the release of the molten charge which would have filled the air with hurtling pieces of shrapnel-like metal.

The men who did the hot and dangerous job were Zip Burgess, master mechanic; C C Hanna, rigger; O W Rice, mechanic; Jim Harlan, rigger; E W Gephart, mechanic foreman; Joe Pelican, mechanic helper; and Ulman Elston, Rufus Woods, Robert Hardnett and Brooks Campbell, furnace tappers.

Webster ¾" No. 783 Dirt Strainer

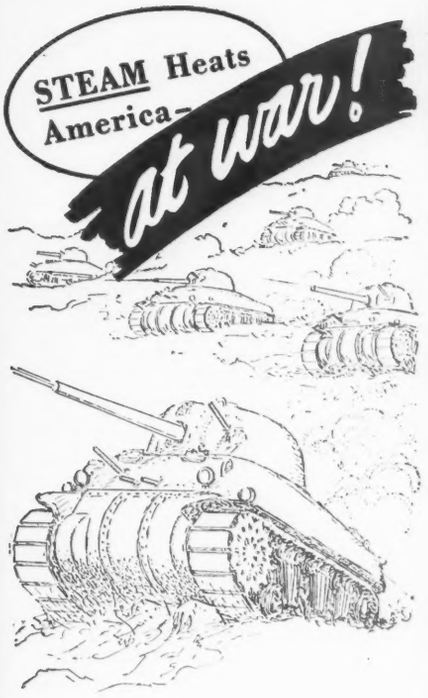
For Trouble-Free Operation

Dirt Strainers

In war-time, the use of Webster Dirt Strainers is an essential element in the trouble-free operation of heating systems or steam using equipment. Placed ahead of Webster Traps at drip points of return piping or of apparatus which is likely to contain core sand, pipe scale, rust or sediment, Webster Dirt Strainers catch and hold foreign matter where it cannot impair the efficiency of the trap. Sediment basket of perforated copper base alloy is easily removed for cleaning. Installed with Unit Heaters in aircraft factories, war plants, etc. Used extensively by U. S. Navy to assure proper drainage of heating equipment on shipboard. Made with iron bodies, covers and plugs for general use—to conform with simplification program of War Production Board. Brass bodies for ship use and essential services under suitable priority. Sizes—½" to 2". Complete information in Bulletin 1200E. Write for a copy.

Keep your present Webster Equipment in first-class condition—add years of life to your heating system —by following the practical heating advice in Webster Service Bulletin S-500-E. A copy is yours for the asking.

WARREN WEBSTER & COMPANY
CAMDEN, N. J., EST. 1888, PIONEERS OF VACUUM STEAM HEATING



SWIFT, hard-hitting tanks . . .

45 thousand in 1942 . . .

75 thousand in 1943 . . .

That is America's promise to the Victory Program—and America is going to beat that promise.

It calls for construction miracles . . . huge plants to house vast assembly lines . . . new plants for principal parts suppliers.

As America builds for Victory, every cubic foot of space must be properly heated to insure maximum production.

For fifty years, steam has been recognized as the outstanding heating medium. Steam, harnessed and brought under control with Webster Steam Heating Equipment, has proved its ability to provide maximum comfort, economy and trouble-free operation.

Today, all of our facilities not required for direct war work are freely offered to architects, engineers and heating contractors working on war construction.

Essential repairs for Webster Systems are available on A-10 priority, under W.P.B. Emergency Repair Order P-84. Orders should be limited to actual needs.

Warren Webster & Company, Camden, N. J.
Representatives in 65 principal Cities

Webster
Steam Heating

This is one of a series of advertisements that will tell the public of the part that Webster Steam Heating and the Webster organization plays in the war effort . . . appearing regularly in leading business, industrial, engineering and technical publications.

UNERRING

THROUGH long and intensive training, thousands of young American pilots are daily learning the "unerring control" that is already making our Air Force a deadly menace to the enemies of our Country.

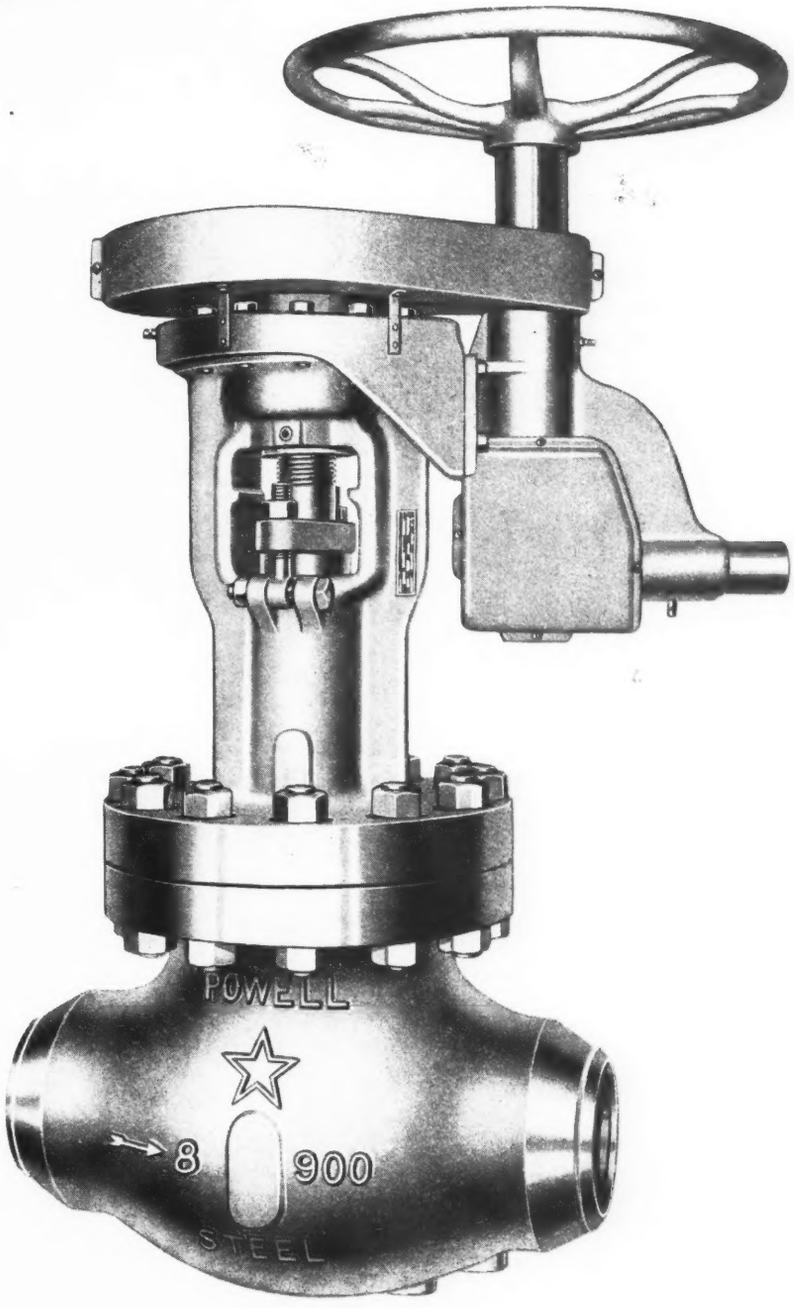
And through nearly five generations, the men of Powell have been in training to make the valves that are so important in the production of the planes themselves and of the gas and oil to "keep 'em flying." For in every plane are assembled the results of many and varied manufacturing and fabricating processes. In each of these processes, valve control—unerring control—is a vital necessity.

As a result of nearly a century of practical experience and scientific achievement, POWELL Valves are meeting every day the most exacting requirements of our stupendous program for Victory.

THE WM. POWELL COMPANY
Cincinnati, Ohio

POWELL

Control



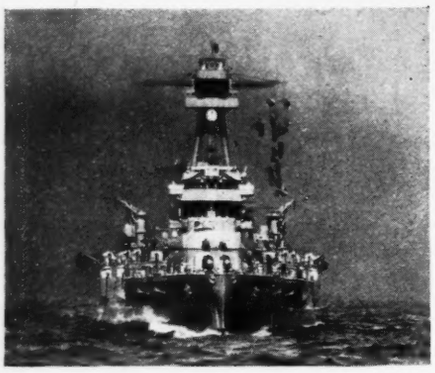
This Powell 8-inch, Class 900 pound, welding end Globe Valve meets every demand of the modern power plant for equipment to handle higher steam pressures and temperatures. Made of cast steel, with seats and discs hard faced with Stellite, it is designed for 900 pounds W. S. P. at 900 F. Anti-friction bearing yoke and gears provide quick, easy operation. Handwheel is mounted on top, and an extension stem can be provided at side for remote operation.

VALVES

WING AXIAL FLOW BLOWERS ARE IN USE IN INDUSTRIAL PLANTS EVERYWHERE

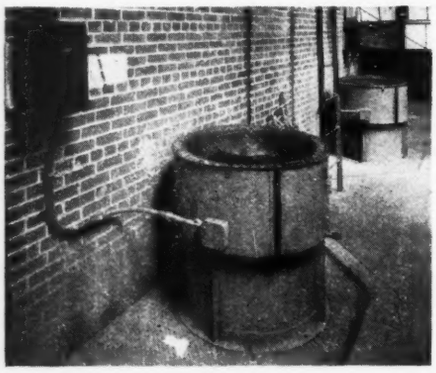
WING Pioneered th A

WING Axial Flow Blowers have been used in the Navy and Merchant Marine for over 4 years.

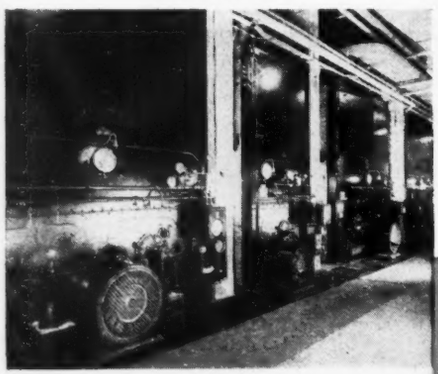


WING Axial Flow Blowers are being used on battleships, cruisers, destroyers, aircraft carriers, minesweepers, etc.

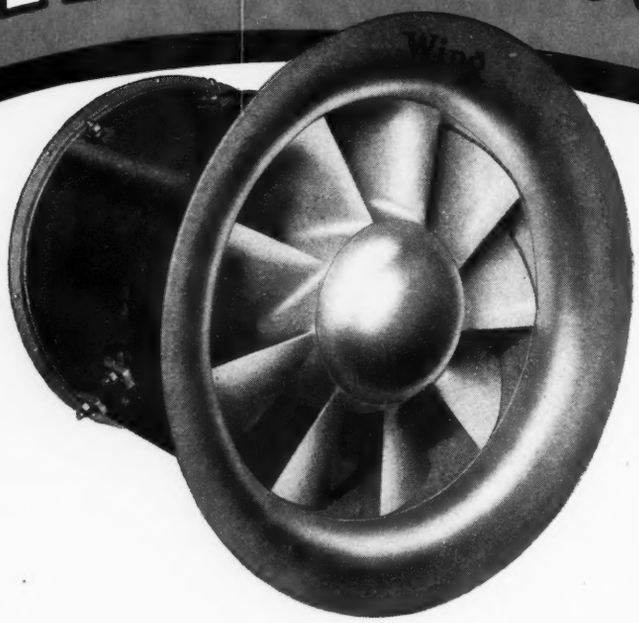
WING Type EMD Axial Flow Blowers have been used in this large defense plant for over 3 years.



WING Type COM Axial Flow Blowers are supplying forced draft to the boilers in the power plant of this airplane plant.



WING Type COM Axial Flow Blowers have been in use in this large educational institution for over 3 years.



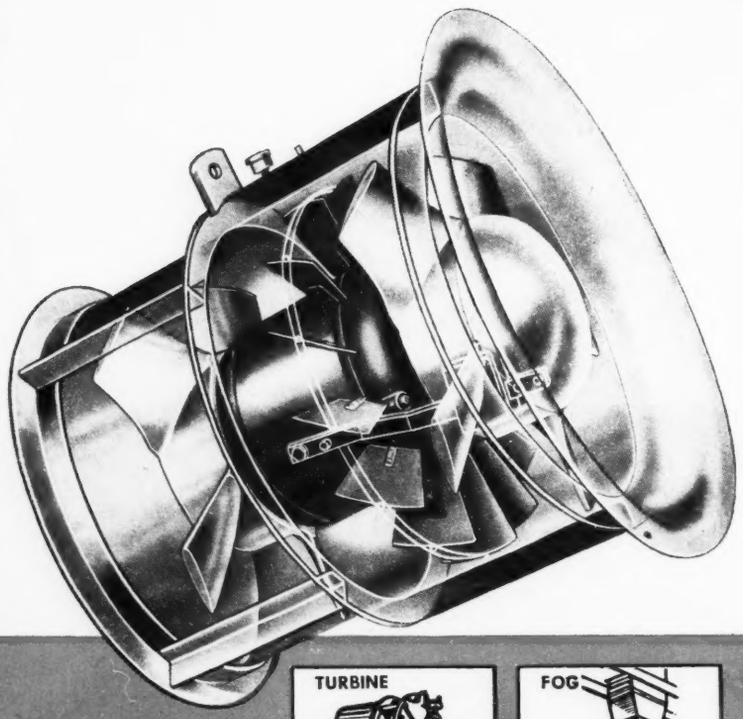
Type EMV
Type EMD

A remarkably compact single stage Blower, ordinarily used for static pressures up to 3" at moderate motor speeds Type EMD is furnished with adjustable damper vanes.

WING pioneered the Axial Flow Blower for use in industrial plants over five years ago and because of its High Efficiency and fine Performance Characteristics WING has been building vast numbers of these fans for the U S. NAVY and other branches of our armed forces

WING Single Stage (Type EMV or EMD) Axial Flow Blowers for static pressures up to 3" *WING Two Stage* (Type COM) Axial Flow Blowers for static pressures up to 7". These pressures are obtained even at the moderate speeds of standard commercial motors. The blowers may be controlled manually automatically. *WING* Turbine Blowe incorporating these Axial Flow Fa generate much higher static pressure

Five years of highly satisfactory servi in marine and industrial applications a the best answer to the value of WIN Axial Flow Fans in forced draft or ve tilating work. While the Axial Flow Fan new to some in this field, the WING Axi Flow Fan is a time-tested veteran in t navy and many important industrie



Type COM

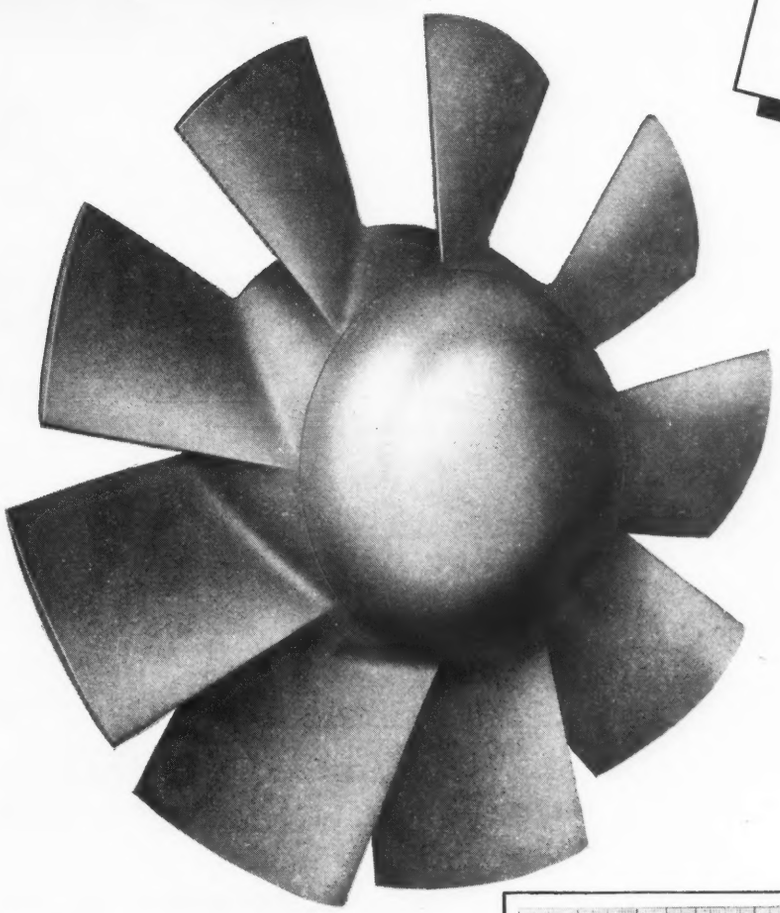
A two stage Axial Flow Blower with adjustable built-in control - vanes. For static pressures up to 7" at moderate motor - speeds.

TURBINE BLOWERS

FOG ELIMINATORS

PROCESS HEATERS

AXIAL FLOW BLOWER



WING AXIAL FLOW FANS ARE CHARACTERIZED BY

HIGH EFFICIENCY—

Total head efficiencies run 90% and higher (See performance curve below.)

NON-OVERLOADING HP CHARACTERISTICS

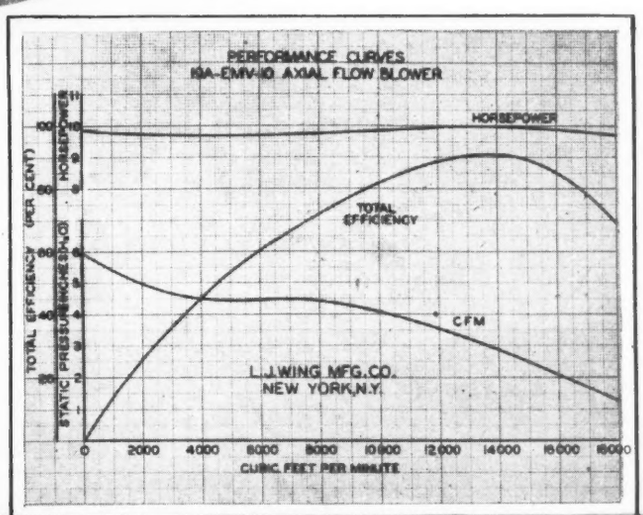
GREAT COMPACTNESS —ECONOMY OF SPACE

EASE OF CONTROL

QUIET OPERATION

●

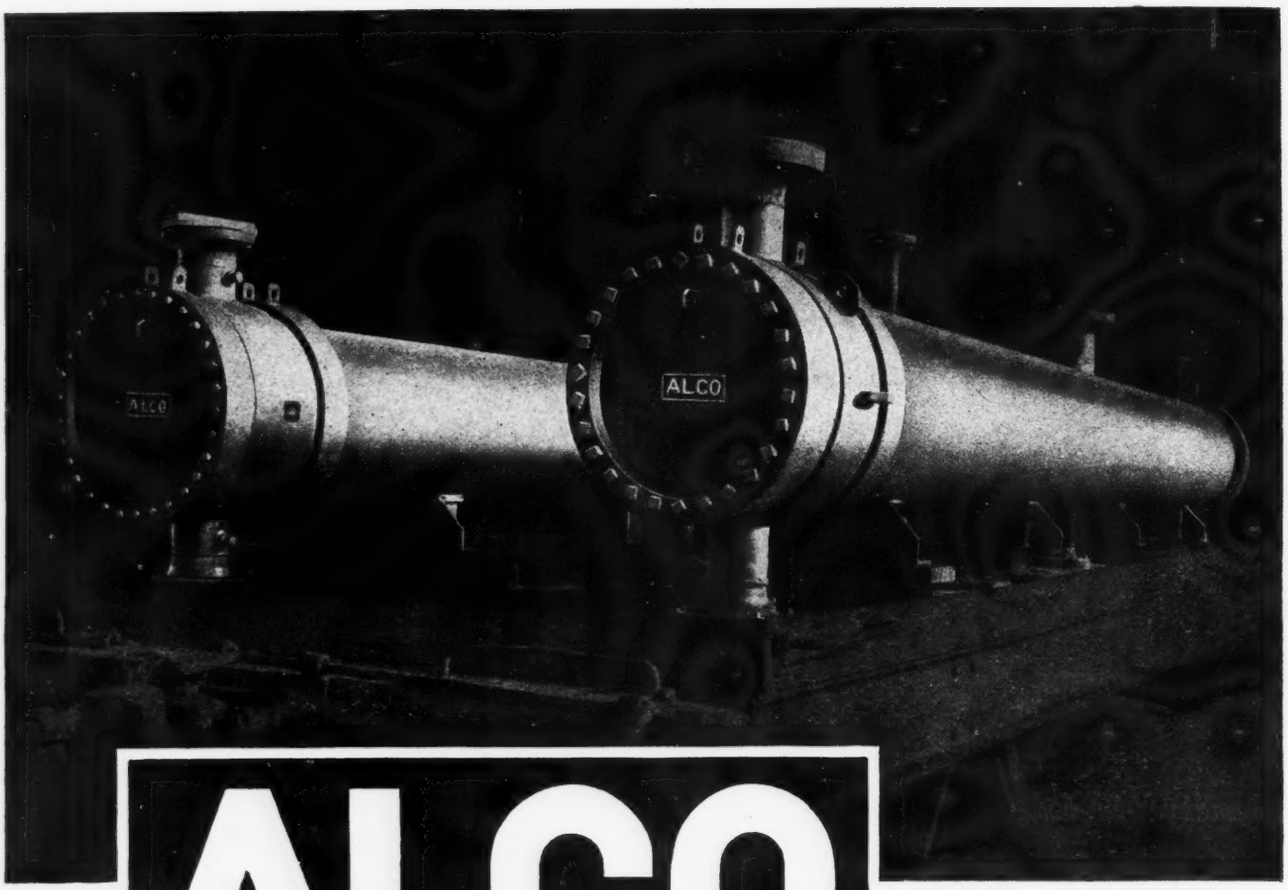
All these great advantages of the WING AXIAL FLOW BLOWER have been and continue to be *at the Service of American Industry.*



L. J. WING MFG. CO.

West 14th St. and 7th Ave., New York, N. Y.

MOTOR DRIVEN BLOWERS | VENTILATING FANS | REVOLVING UNIT HEATERS | EXHAUSTERS | FLOODLIGHT HEATERS | STEAM TURBINES



High Pressure Feed Water Heaters

ALCO

BOILER FEED WATER HEATERS...

BUY **ALCO HEATERS** AND BE ASSURED OF LONG AND EFFICIENT SERVICE. ALL ALCO HEATERS INCORPORATE THE FOLLOWING FEATURES:

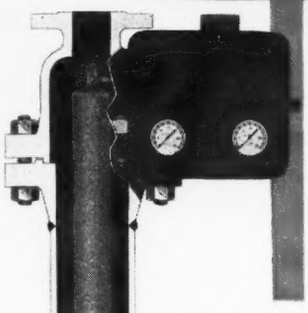
1. Alco Clamp Ring Joints with Compression Bolting
2. Tongue and Groove Type Gaskets of Fully Armored Iron with Asbestos Inserts
3. Liberal Number of Heavy Tube Supports
4. Large Volume Air Venting Sections

FURTHER DETAILS IN BULLETIN No. 1024

AMERICAN LOCOMOTIVE COMPANY
ALCO PRODUCTS DIVISION
30 CHURCH ST., NEW YORK, N. Y. **DUNKIRK, N. Y.**

FOR ALL APPLICATIONS STANDARDIZE ON FISHER LEVEL-TROLS

A Complete Series of Automatic Controllers for Liquid Level Control . . Interface Level Control . . Liquid Level Indication . .



Type 2400-248A. Extra wide range float cage type for pressures up to 600 lbs. A.S.A. rating.

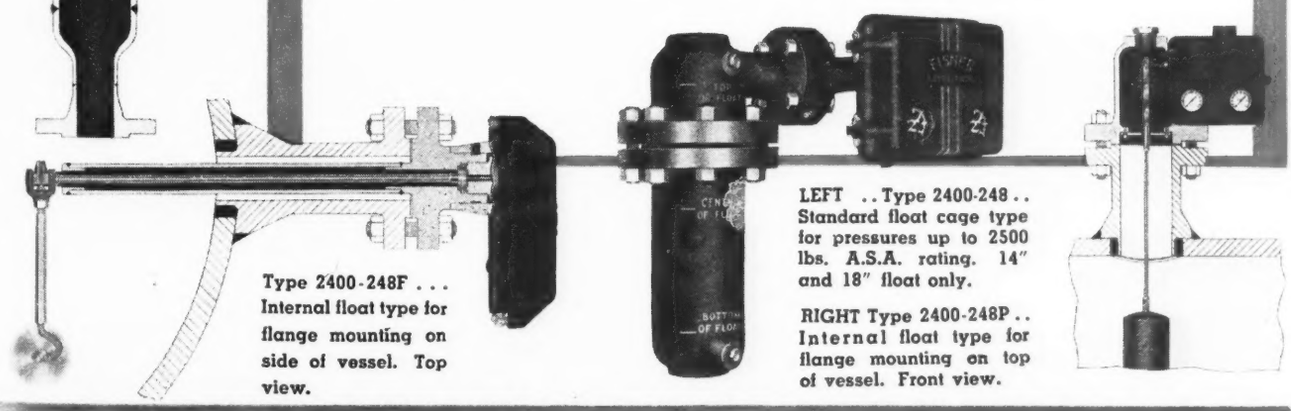
Now you can standardize on ONE type of Liquid Level Controller for your entire plant requirements. FISHER LEVEL-TROLS . . . the finest of all Level Controllers . . . are available in many designs for every service requirement.

Float cage types with screwed or flanged equalizing connections or internal float types for mounting on the top or side of vessels. Furnished with floats 14" to 120" in length to meet varying service requirements. Suitable for controlling liquids of all specific gravities at all pressures and temperatures.

ALL LEVEL-TROLS FEATURE:

1 — 100% pneumatic type pilot insures maximum sensitivity.
2 — Pilot relay speeds response to level change.
3 — Torque tube construction assures trouble-free operation.
4 — Throttling range adjustment affords wide range of control.
5 — Level position adjustment for resetting liquid level.

Fisher Level-Trols are completely illustrated and described in Bulletin F-1 now available. Your free copy will be sent on request.



Type 2400-248F . . . Internal float type for flange mounting on side of vessel. Top view.

LEFT . . Type 2400-248 . . Standard float cage type for pressures up to 2500 lbs. A.S.A. rating. 14" and 18" float only.

RIGHT Type 2400-248P . . Internal float type for flange mounting on top of vessel. Front view.

FISHER GOVERNOR COMPANY
FISHER BUILDING
MARSHALLTOWN, IOWA

Uncle Sam Says—

CONVERT TO COAL *Now* for Victory

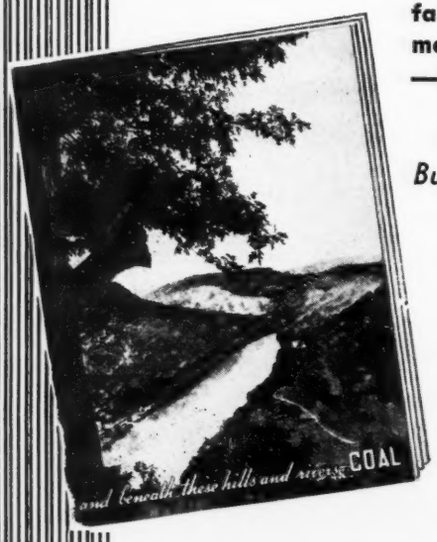
Good engineering is most essential in making conversions from oil to coal fuel. The penalties of poor engineering and a makeshift job are too great. The life of the plant depends on the changeover being skillfully done.

Failure to conform to good engineering standards and practices affecting burning rates, heat release, combustion space, radiant heat, boiler baffling drafts and coal and ash handling equipment will reduce capacity and make an invalid out of the plant.

Because of the critical fuels situation, the conversion job should be *designed* to give maximum latitude in coal selection. It must be recognized that the majority of coals available fall in the low or medium ash fusion range.

The Pittsburgh Seam Coal from the Fairmont Region of West Virginia, with its tremendous reserves and expanded mining facilities, is a great fuel arsenal for converted war plants. Learn more about this "Victory" fuel by requesting a copy of the brochure —Coal.

In planning conversions, draw on the experience of the Bureau's staff of Fuel Engineers.



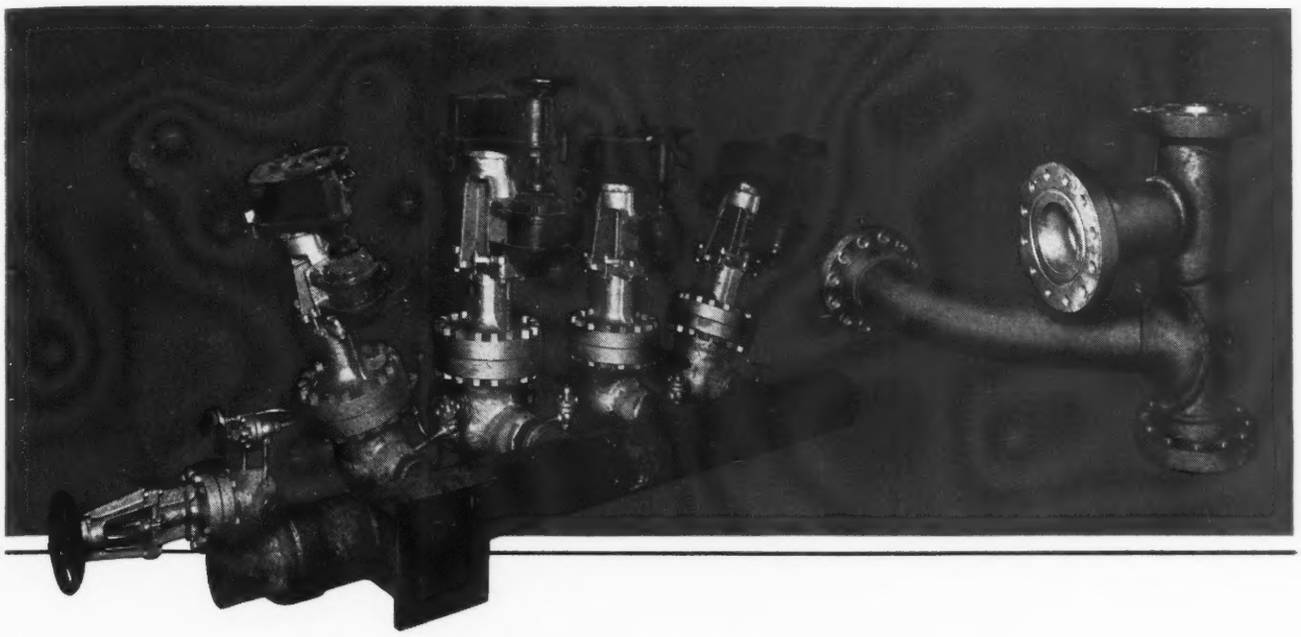
We invite your inquiries.

COAL BUREAU

Upper Monongahela Valley Association

Peoples Building

Fairmont, West Virginia



Controlled WELDING

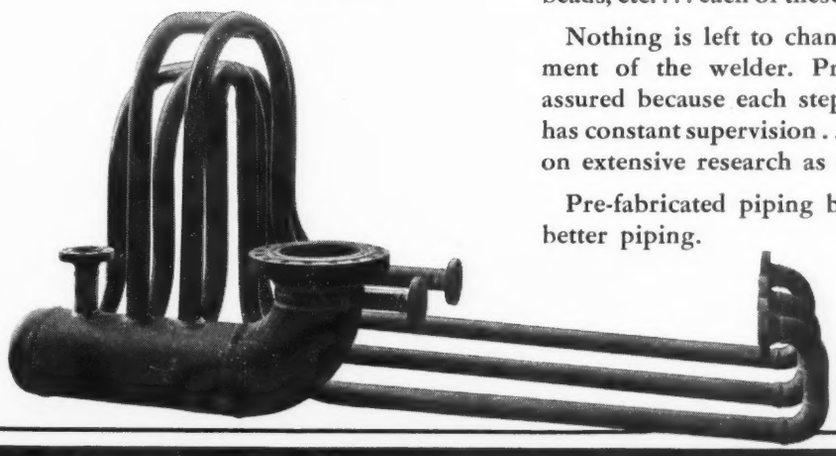
A *Vital Advantage* OF PRE-FABRICATED PIPING

The importance of accurate control of the welding of pressure piping cannot be overemphasized . . . a piping system is only as good as its welding.

That is why the qualified pipe fabricator employs in his shops highly skilled welders who have been trained and qualified on pressure piping (alloy steel as well as carbon steel). Every operation in the pre-fabrication of welded sub-assemblies is under exact control. Position of weld . . . type of weld . . . preparation and spacing of welding ends . . . rod size and material . . . amperage . . . number of beads, etc. . . . each of these is under specific control.

Nothing is left to chance or the whim or judgment of the welder. Predetermined results are assured because each step is exactly specified and has constant supervision . . . procedures being based on extensive research as well as shop experience.

Pre-fabricated piping by *qualified* fabricators is better piping.



THE PIPE FABRICATION INSTITUTE

1108 CLARK BUILDING • PITTSBURGH, PA.

A.P.I.—A.S.M.E. and A.S.M.E. CODES • CARBON STEEL AND SPECIAL STEEL

WELDED PRODUCTS by Vogt

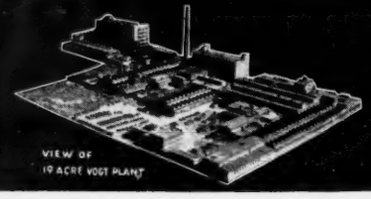
1 - 4'—0" dia. x 7'—6" dia. x 82'—5" high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 - Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 - 48" dia. x 22'—6" long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

4 - Battery of Absorption Columns in a Western Refinery. Units are 33" dia. x 41'—0" high and were stress relieved after welding.

5 - 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.



VIEW OF 19 ACRE VOGT PLANT

HENRY VOGT MACHINE CO.
Incorporated
LOUISVILLE, KENTUCKY
BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO · DALLAS

BENJAMIN F. SHAW CO.
answers the demand
"GET IT DONE!"

"Needed fast are new plants . . . expansion of old ones . . . to meet America's great war needs for Explosives, Synthetic Rubber and 100 Octane Aviation Gasoline.

"In this vital construction work, piping for processing—piping for power generating stations—piping of all sorts, shapes, sizes and built to stand all types of pressures and temperatures is essential.

"This piping has to be fabricated—(that is—bent, flanged, welded, heat treated, in short, custom-built to fit the individual job)—then it has to be installed.

"And it must be done quickly—efficiently.

"Benjamin F. Shaw Company has been engaged 100% in this vital war work for months—is working today every hour of the day, every day of the week on it.

"In its piping prefabrication jobs all over the country approximately 5,000 men under the direction of Shaw engineers are answering the demand 'Get It Done'.

"And a great majority of these Shaw workers are investing regularly out of each pay in War Bonds."

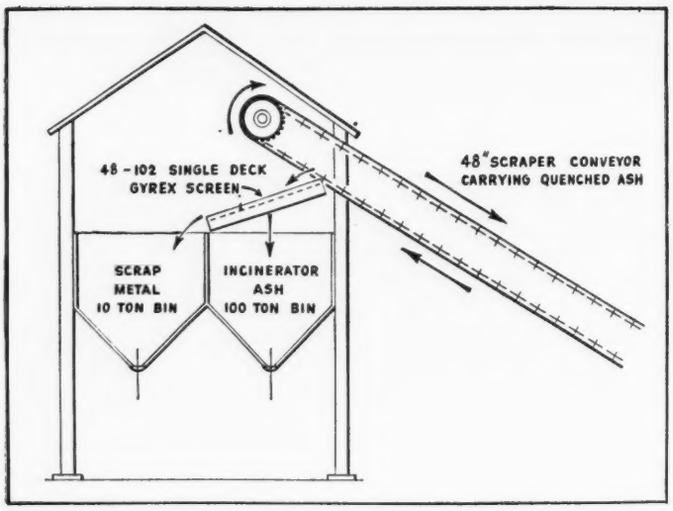
Benj. F. Shaw III

President

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS, CONTRACTORS AND DISTRIBUTORS



Pittsburgh Salvages 10,000 tons of Scrap —and nets $60,000

Robins engineers and machinery often participate in interesting installations. Many of them are unusual, some actually unique. One in the latter classification came up recently in Pittsburgh. Mr. D. C. Agar, Managing Engineer of the Bureau of City Refuse, wanted to salvage the scrap in city residue agglomerate. The screening methods used in coke plants seemed a logical and economical method of separation.

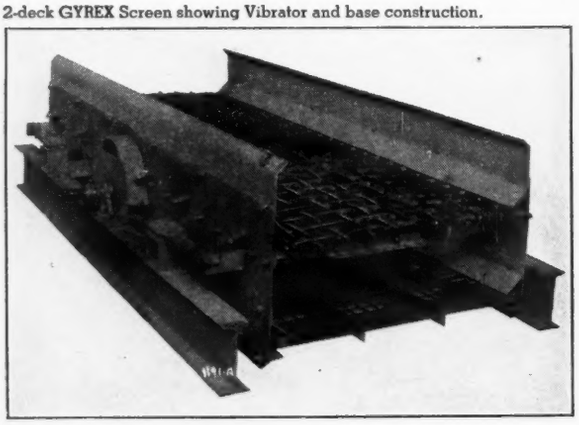
■ A suspended-type Robins GYREX Vibrating Screen was installed where it would receive material from the final scraper conveyor . . . at a total cost considerably less than $5,000.

■ At the present rate of recovery (and current contract selling-price) the City of Pittsburgh is recovering 10,000 tons of scrap for the war effort . . . and will net $60,000 a year from the salvaged metal.

■ Robins engineers are at your disposal for advice regarding economical efficient applications of screens and materials handling machinery.

ROBINS
CONVEYING BELT COMPANY
PASSAIC • N. J.

2-deck GYREX Screen showing Vibrator and base construction.



For Material Aid
in
Materials Handling
It's ROBINS

SAFLEX

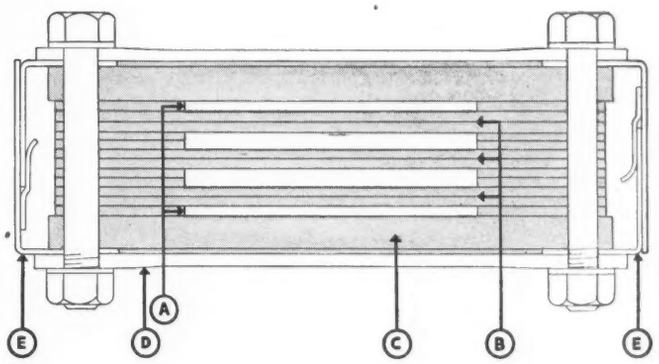
(LOW REACTANCE) FEEDER DUCT

✔ Only 1.8 Volts drop per 100 feet
✔ Phases balanced at all points
✔ Only 38° C. temperature rise

Square D Saflex (Low Reactance) Feeder Duct is designed to serve as the feeder between transformer banks and main switchboard or as feeders to branch circuits where minimum voltage loss is essential. Because of its low reactance and consequent low voltage drop, it is ideally suited for welder circuits and, as a result, conductor size may be kept at a minimum.

The special non-critical insulation of Saflex Feeder Duct also constitutes approximately 80% of its housing, thus eliminating large use of vital war materials such as steel. Saflex Duct is available in standard 10-foot sections with special fittings to meet all types of building structures.

Let a Square D Field Engineer give you the complete story.



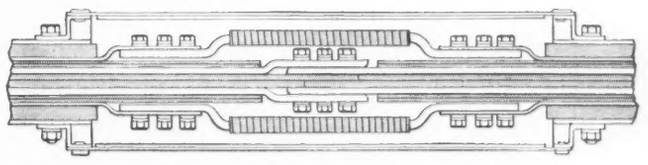
A Split Bus. Assures uniform and low voltage drop because it provides close spacing and electrical symmetry of phases.

B ¼" Insulated Space between opposite busses also helps to keep voltage losses at a minimum.

C Special Insulation totally encloses busses. Has high mechanical and dielectric strength, is impervious to moisture and resistant to an arc. Conducts heat readily and thus insures low temperature rise.

D Surge Clamps every 24 inches give structural and mechanical strength to withstand 50,000 amperes short circuit with a substantial factor of safety.

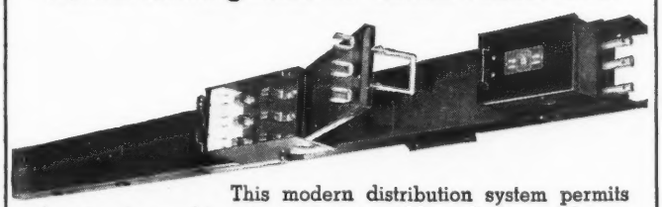
E Steel Channels at top and bottom complete the housing which totally encloses the busbars.



Connection between Bus Sections (*top view*)
Note that all bolts for joints face outward and are accessible through hand hole openings which provide ample working space. Steel cover plates over hand holes are easily and quickly removed.

SAFLEX PLUG-IN DUCT

Perfect running mate for Saflex Feeder Duct



This modern distribution system permits plugging in machines just as you would appliances at home. Busses are rigidly supported, round copper bars and tubes with expansion couplings every ten feet. Units are easily attached and disconnected. 100% salvage value for re-use. 2, 3 and 4 wire services, 600 Volts or less.

CALL IN A SQUARE D MAN

SQUARE D COMPANY
DETROIT - MILWAUKEE - LOS ANGELES
KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK
IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

Pipe, kilowatts . . .

Three of Republic's P-47 Thunderbolts—2000-horse-power substratosphere sluggers designed to knock out high-flying enemy aircraft.

THEY'RE all tied up together. To produce the warplanes you need electric power. To get that power, you need, among other things, enormous tonnages of pipe—big, little, black, galvanized, high-pressure or low-pressure pipe.

Here in the Bethlehem organization we're working hard to supply the power industry with the most and best pipe we can make. Beth-Co-Weld, our continuous-weld pipe, is on duty in power plants and dozens of related war activities throughout the nation. Beth-Co-Weld pipe is made on new continuous mills by men who know their business from A to Z. Beth-Co-Weld is doing a thoroughly dependable job in the American war effort. If you've got war contracts and need good pipe for your plant—use Beth-Co-Weld. It won't let you down.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

APPLETON, WIS.
BALTIMORE, MD.
CHICAGO, ILL.
CINCINNATI, OHIO
CLEVELAND, OHIO
DAVENPORT, IOWA
DENVER, COLO.
DES MOINES, IOWA
DETROIT, MICH.
FORT WORTH, TEX.
GREENVILLE, S. C.
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MILWAUKEE, WIS.
MINNEAPOLIS, MINN.
MONTREAL, QUEBEC, CAN.
NEW YORK, N. Y.
OKLAHOMA CITY, OKLA.
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PITTSBURGH, PA.
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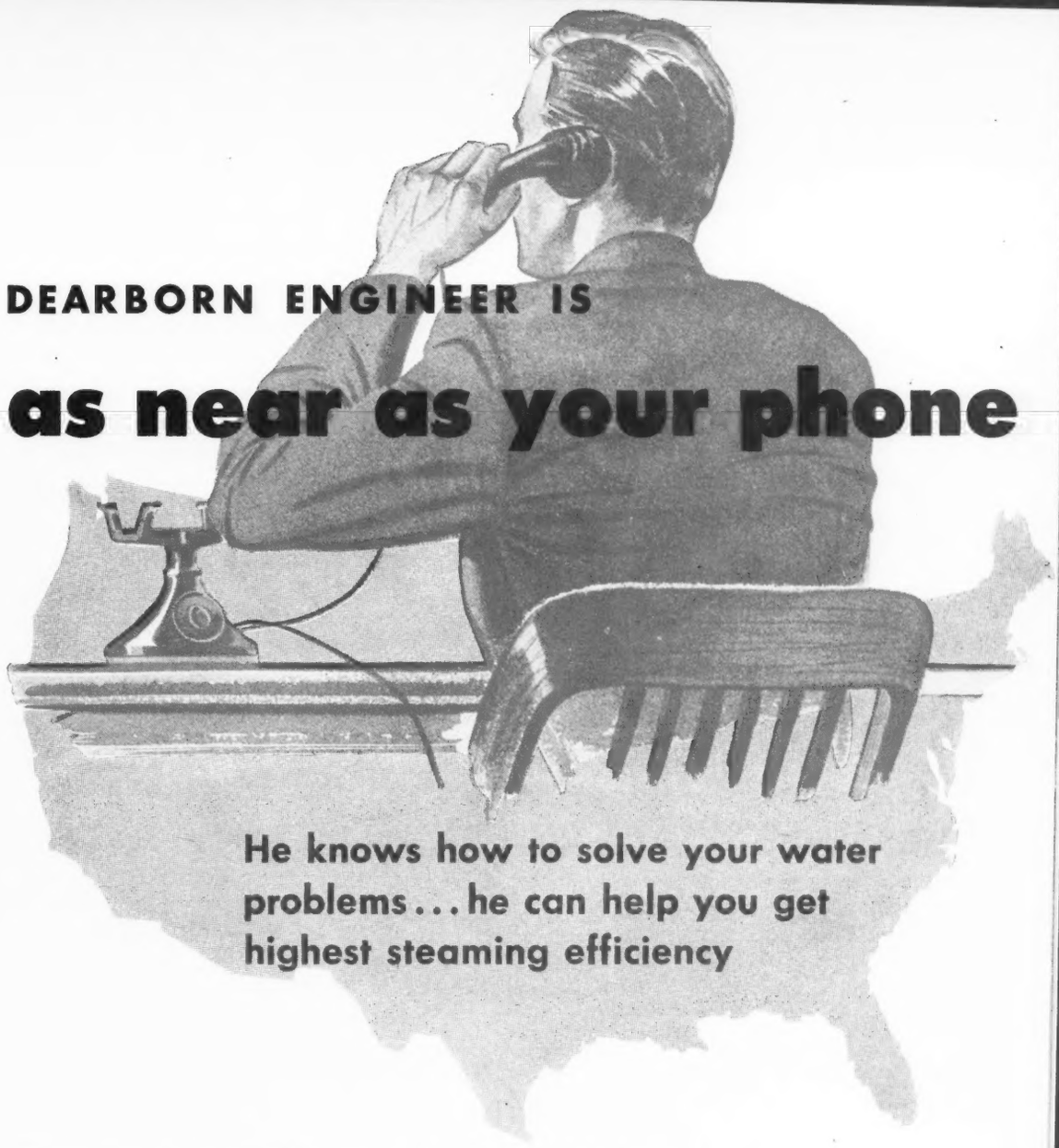
TORONTO, ONTARIO, CAN.
TULSA, OKLA.
HONOLULU, T. H.

DEARBORN ENGINEER IS

as near as your phone



He knows how to solve your water problems... he can help you get highest steaming efficiency

When you're in trouble you need help right away! You can get it by phoning or writing the nearest Dearborn office. Dearborn Engineer is within quick calling distance of your plant. He knows the symptoms of boiler trouble resulting from improper treatment adjustment. He lives and works in the district where your plant is located. If your water is obtained from the local supply, he may even get off to a head start on solving your problem by referring to laboratory tests already on record.

On the job, he is the boiler water expert working with you and through whom you obtain the combined services of laboratory chemists, engineers, and other water conditioning specialists.

Keeping your boilers on the line is a "must". Dearborn Engineer is close by to help you. Write, wire, or telephone.

Dearborn Engineer does this for you...

(1) *Studies* your water and complete plant operating conditions.
(2) *Sends* samples of your water to main laboratory for analysis.
(3) *Recommends* proper chemical treatment and chemical control methods.
(4) *Supervises* installation of feeding equipment.
(5) *Instructs* your men on water test methods for correct treatment dosage adjustment and blow-down control.
(6) *Calls* regularly to insure maintenance of recommended conditions.

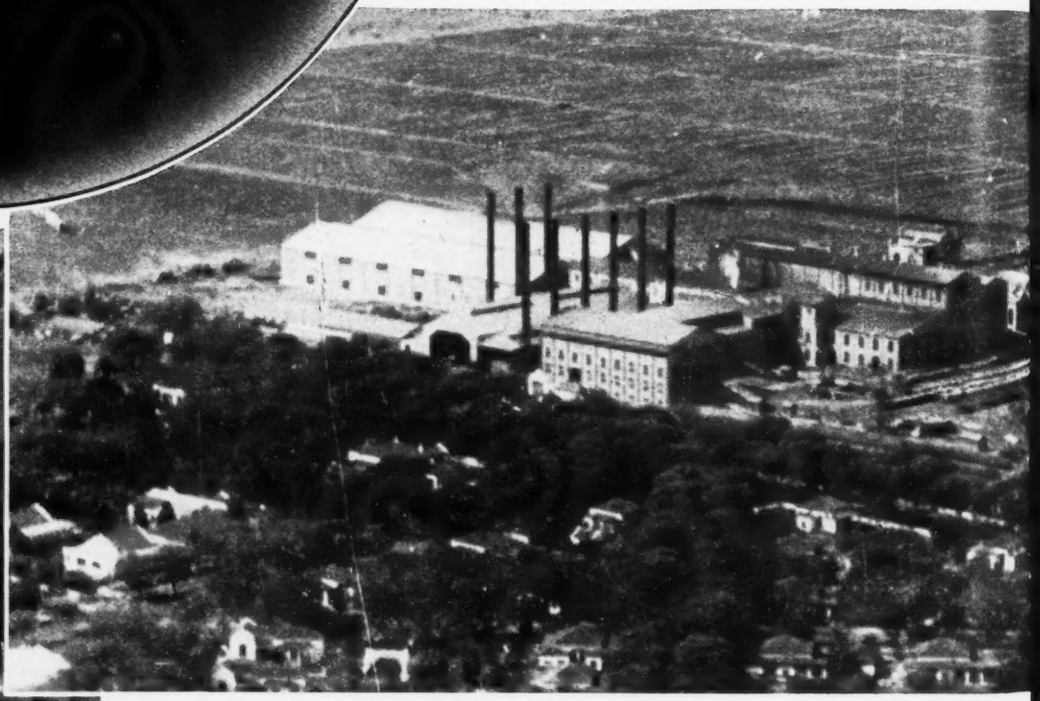
DEARBORN CHEMICAL COMPANY
Dept. D, 310 South Michigan Avenue, Chicago, Illinois

Dearborn
TRADE MARK REGISTERED

WATER TREATMENT AND ENGINEERING SERVICE

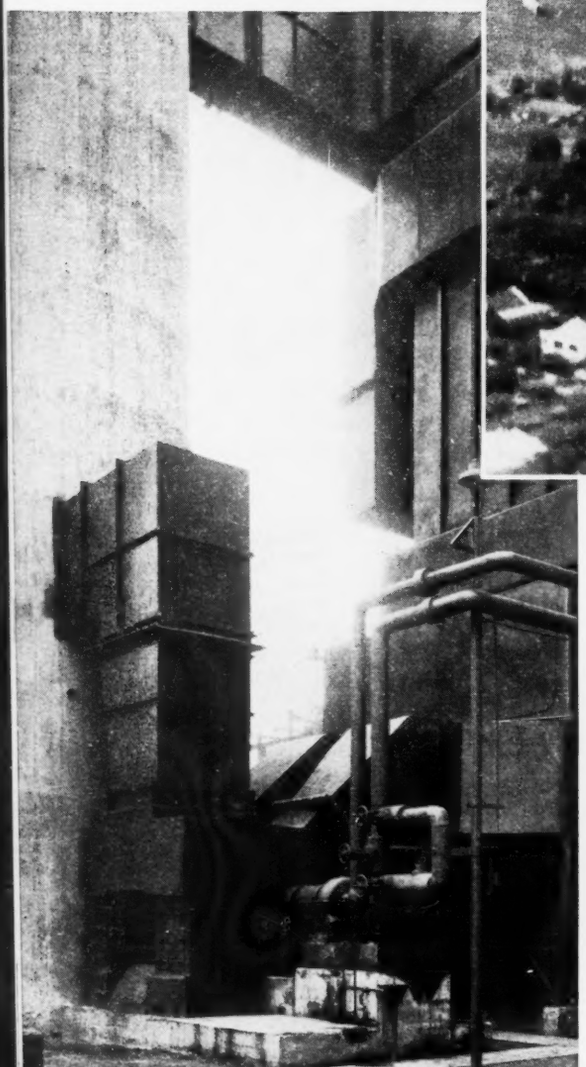
Ace High o

CLARAGE
MECHANICAL DRAFT FANS

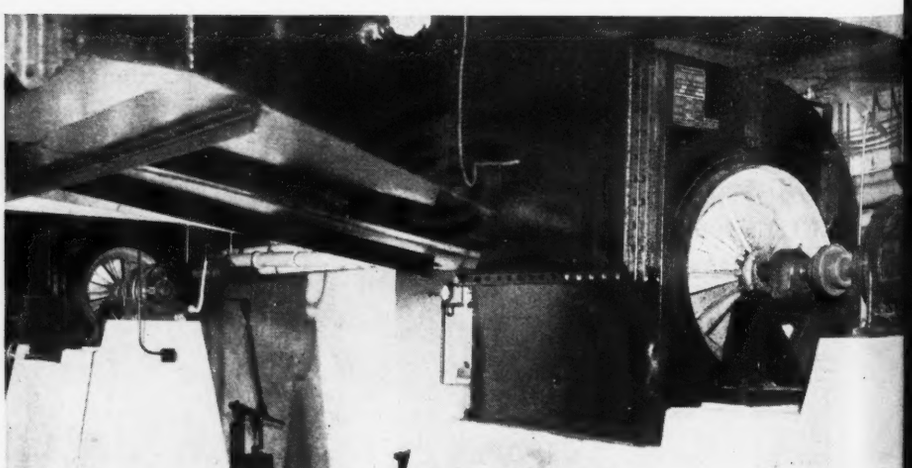


LARGEST SUGAR REFINERY IN SOUTH AMERICA, Province of Salta, Argentine — two Clarage Forced Draft Fans in new power plant extension, servicing two Combustion Engineering boilers.

ENGINEERS: MELLOR-GOODWIN, BUENOS AIRES.



SHELL OIL COMPANY, Wood River, Illinois — Clarage Induced Draft Fan servicing Riley steam generating unit. Installation also includes Clarage Forced Draft Fan. One of the first complete outdoor boiler installations located where sub-zero temperatures occur.



UNITED STATES TOBACCO COMPANY, Richmond, Virginia — two Clarage Fans supplying forced draft. Each fan equipped with Clarage Vortex Control, which furnishes automatic volume regulation.

CONSULTING ENGINEERS: SCHMIDT, GARDEN & ERIKSON, CHICAGO.

on Two Continents

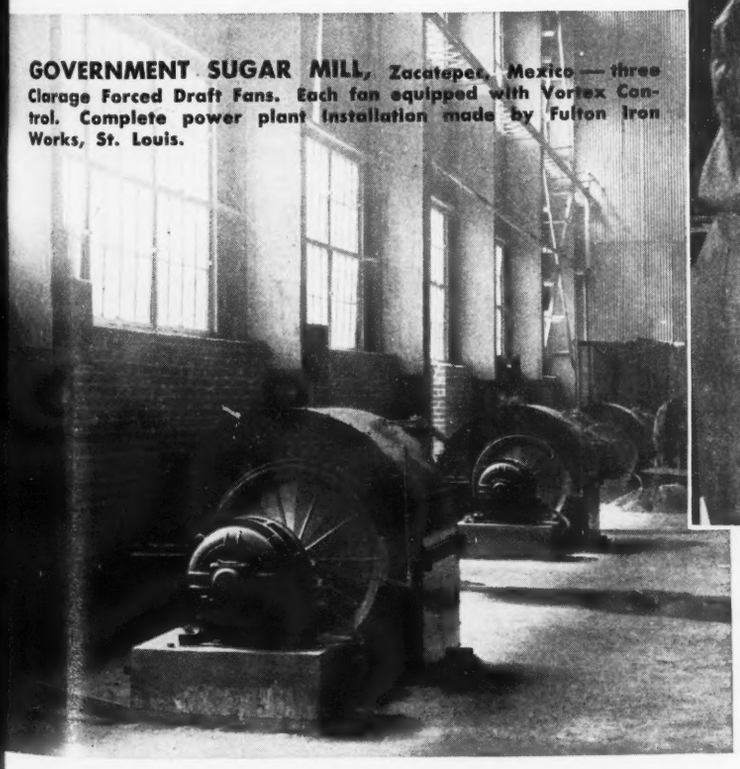
WEADOCK STATION, Consumers Power Company, Bay City, Michigan, uses Clarage Fans for both forced and induced draft. Clarage Mechanical Draft Equipment also operating in Consumers' Comstock, Battle Creek and Kalamazoo plants — Clarage Air Conditioning installed in Consumers' Jackson, Battle Creek and Kalamazoo offices.

Mechanical draft fans bearing the Clarage name are available in types and sizes to meet ALL requirements. *We are specialists in this field — over a quarter-century of experience, having furnished the RIGHT equipment for many thousands of jobs.*

When you select Clarage, you are assured of fan apparatus that measures up to the most advanced ideas in power plant practice — fans equal to any service condition.

If you are engaged in vital war work and are considering a new plant or plant extension, write us outlining your fan problem.

GOVERNMENT SUGAR MILL, Zacatepec, Mexico — three Clarage Forced Draft Fans. Each fan equipped with Vortex Control. Complete power plant installation made by Fulton Iron Works, St. Louis.



U. S. NAVY and ARMY AIR BASES from Cuba to Alaska — a great many of them — are equipped with Clarage Fans. These fans are used for forced draft, induced draft, ventilation, cooling, etc.

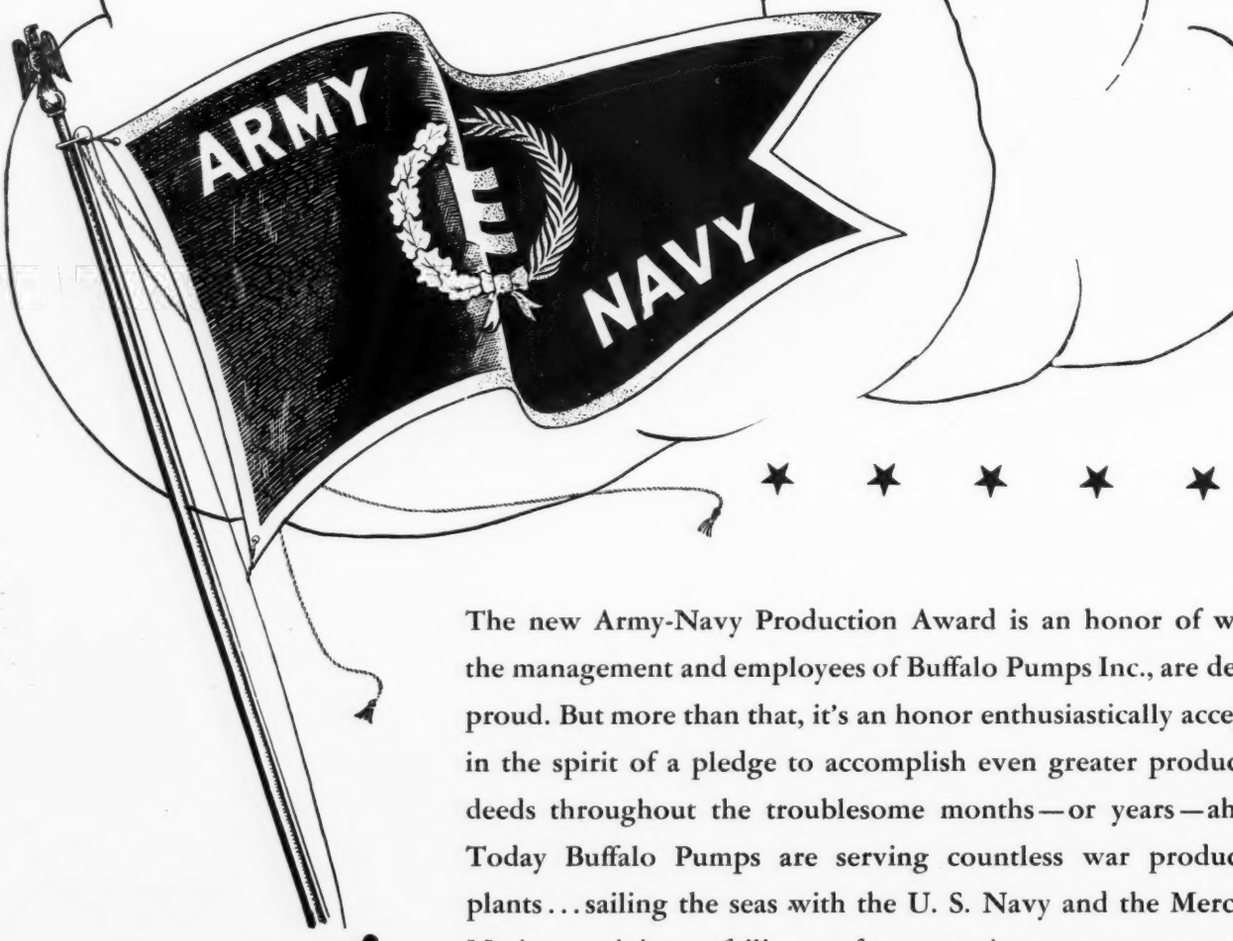
COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY KALAMAZOO, MICH.

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

This Emblem of Excellence

SIGNALS THE PRODUCTION ACHIEVEMENTS OF BUFFALO PUMPS, INC.



The new Army-Navy Production Award is an honor of which the management and employees of Buffalo Pumps Inc., are deeply proud. But more than that, it's an honor enthusiastically accepted in the spirit of a pledge to accomplish even greater production deeds throughout the troublesome months—or years—ahead! Today Buffalo Pumps are serving countless war production plants... sailing the seas with the U. S. Navy and the Merchant Marine... giving unfailing performances in severest emergencies.

"Buffalo"

BUFFALO PUMPS INC.

488 Broadway, Buffalo, New York

Branch Engineering Offices in Principal Cities Canada Pumps Ltd., Kitchener, Ont.

BUFFALO PUMPS INC.

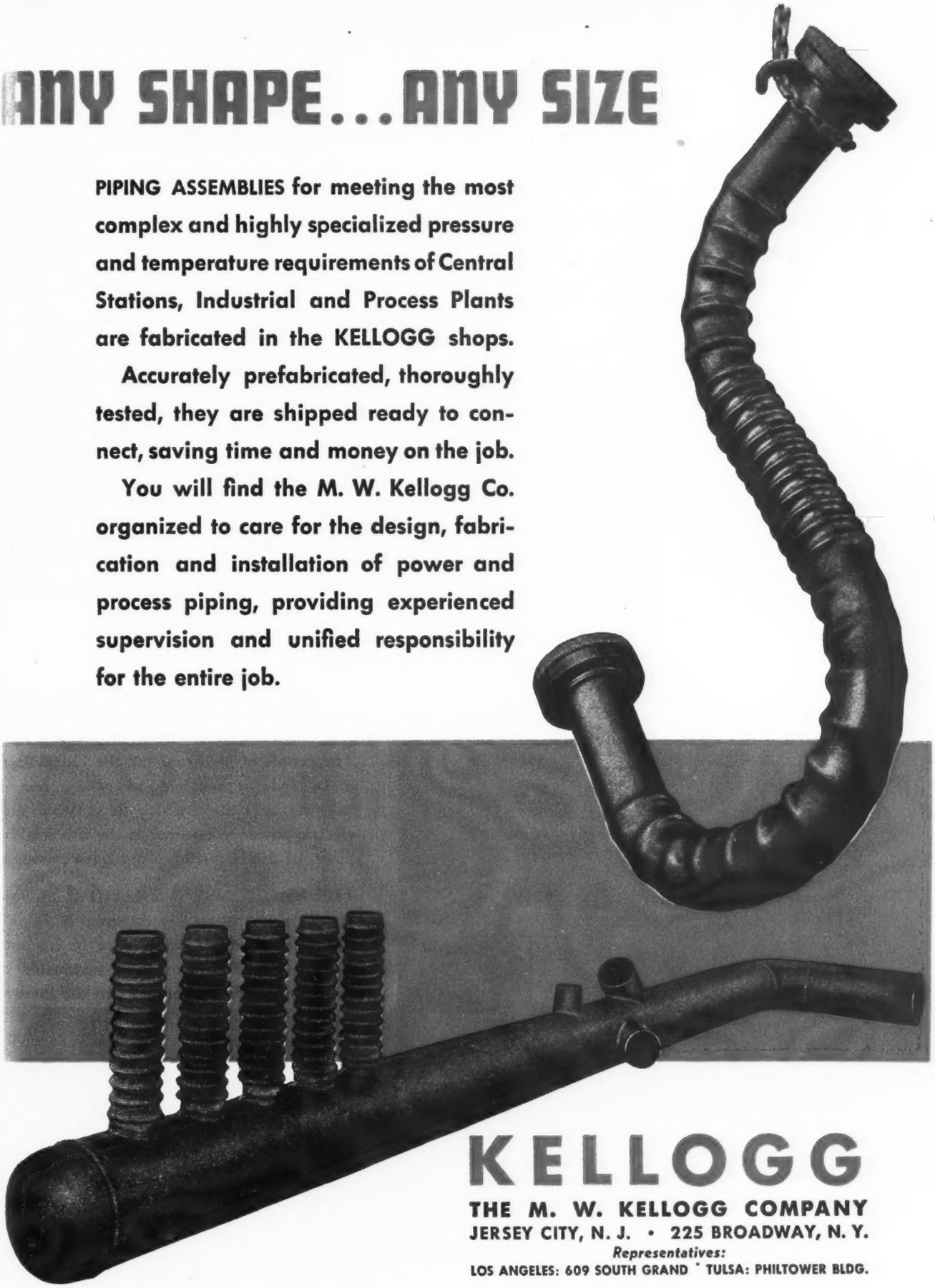
100% IN THE SERVICE OF AMERICA'S ARMED FORCES

ANY SHAPE...ANY SIZE

PIPING ASSEMBLIES for meeting the most complex and highly specialized pressure and temperature requirements of Central Stations, Industrial and Process Plants are fabricated in the KELLOGG shops.

Accurately prefabricated, thoroughly tested, they are shipped ready to connect, saving time and money on the job.

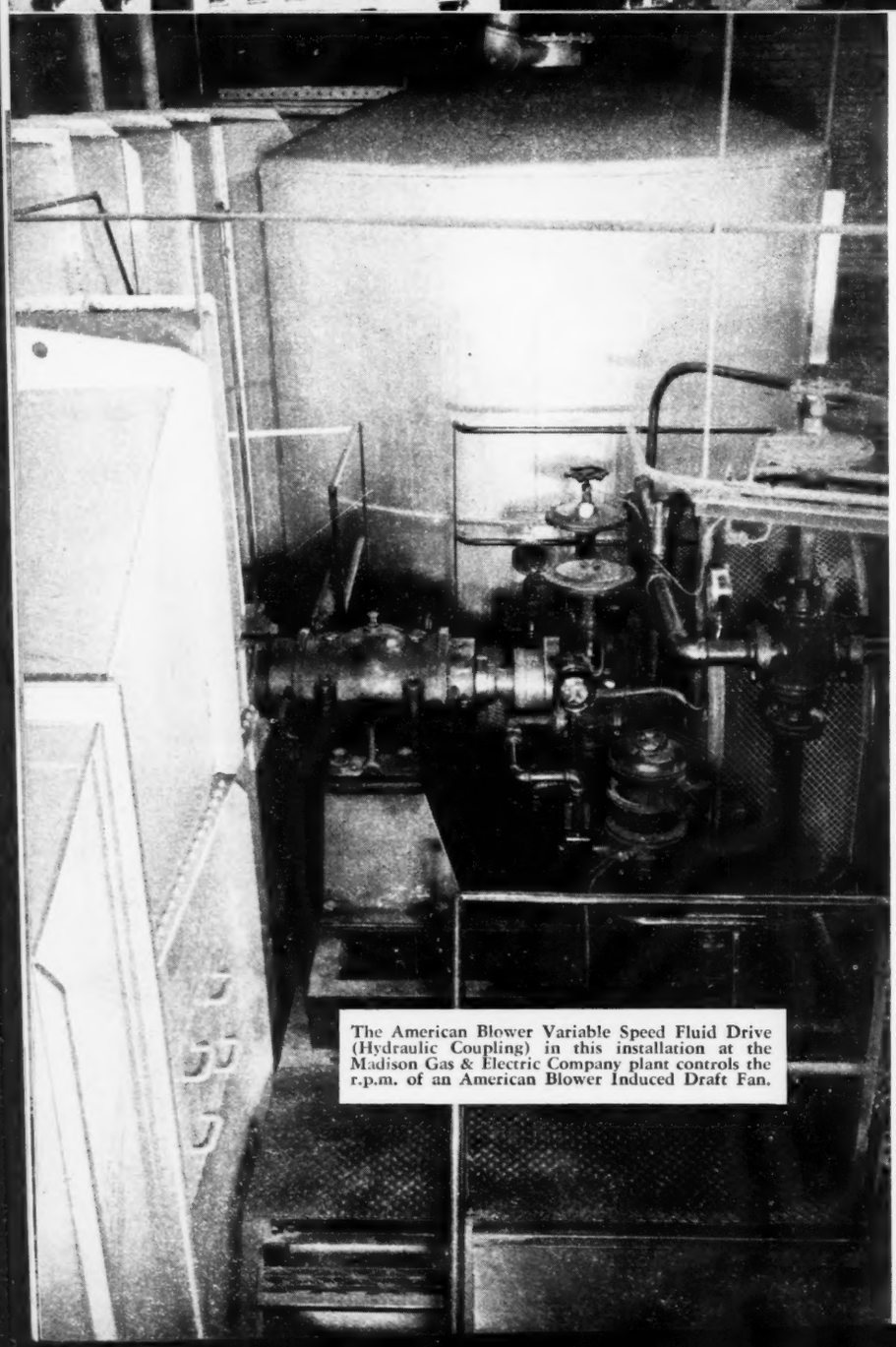
You will find the M. W. Kellogg Co. organized to care for the design, fabrication and installation of power and process piping, providing experienced supervision and unified responsibility for the entire job.



KELLOGG

THE M. W. KELLOGG COMPANY
JERSEY CITY, N. J. • 225 BROADWAY, N. Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND • TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization, Thermal and Catalytic Polymerization Units JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.



The American Blower Variable Speed Fluid Drive (Hydraulic Coupling) in this installation at the Madison Gas & Electric Company plant controls the r.p.m. of an American Blower Induced Draft Fan.

. . . AND ON, MADISON—Capital and Universi City of Wisconsin! Madison is going ahead — fa doubling its population between 1900 and 1920, a again between 1920 and 1940. Madison's more th 66,000 residents are rightly proud of their city—the university, schools, industries, libraries, hospita parks and lakes. They're proud of the million-doll U. S. Forest Products Laboratory — first in the worl The people of Madison, and the 17,000 students wh make Madison their home every year, take just prid too, in the Utility which dependably supplies th electric power so essential to the life, health and hap piness of this beautiful, progressive community.

THE MADISON GAS & ELECTRIC COMPANY in step with progress — consistently improving an expanding its facilities to serve its customers bette with vital electric power at reasonable cost. An American Blower takes pride in the knowledge tha American Blower Mechanical Draft and Fluid Driv (Hydraulic Coupling) equipment is dependably func tioning as a part of this modern system.

IF YOU HAVE ANY PROBLEM involving the appli cation of Forced or Induced Draft Fans or Fluid Drives (Hydraulic Couplings), phone or write the near- est American Blower branch office.

AMERICAN BLOWER

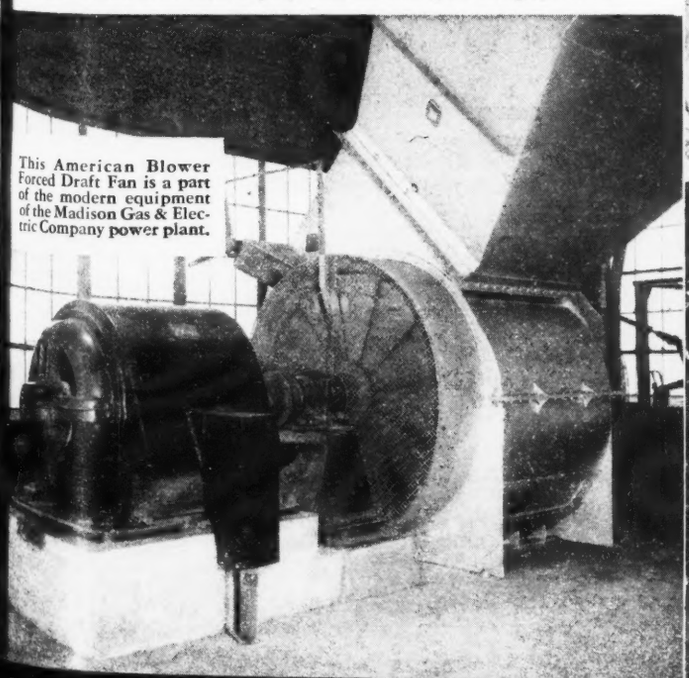
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO
Division of AMERICAN Radiator and Standard Sanitary Corporation

CONSIN!

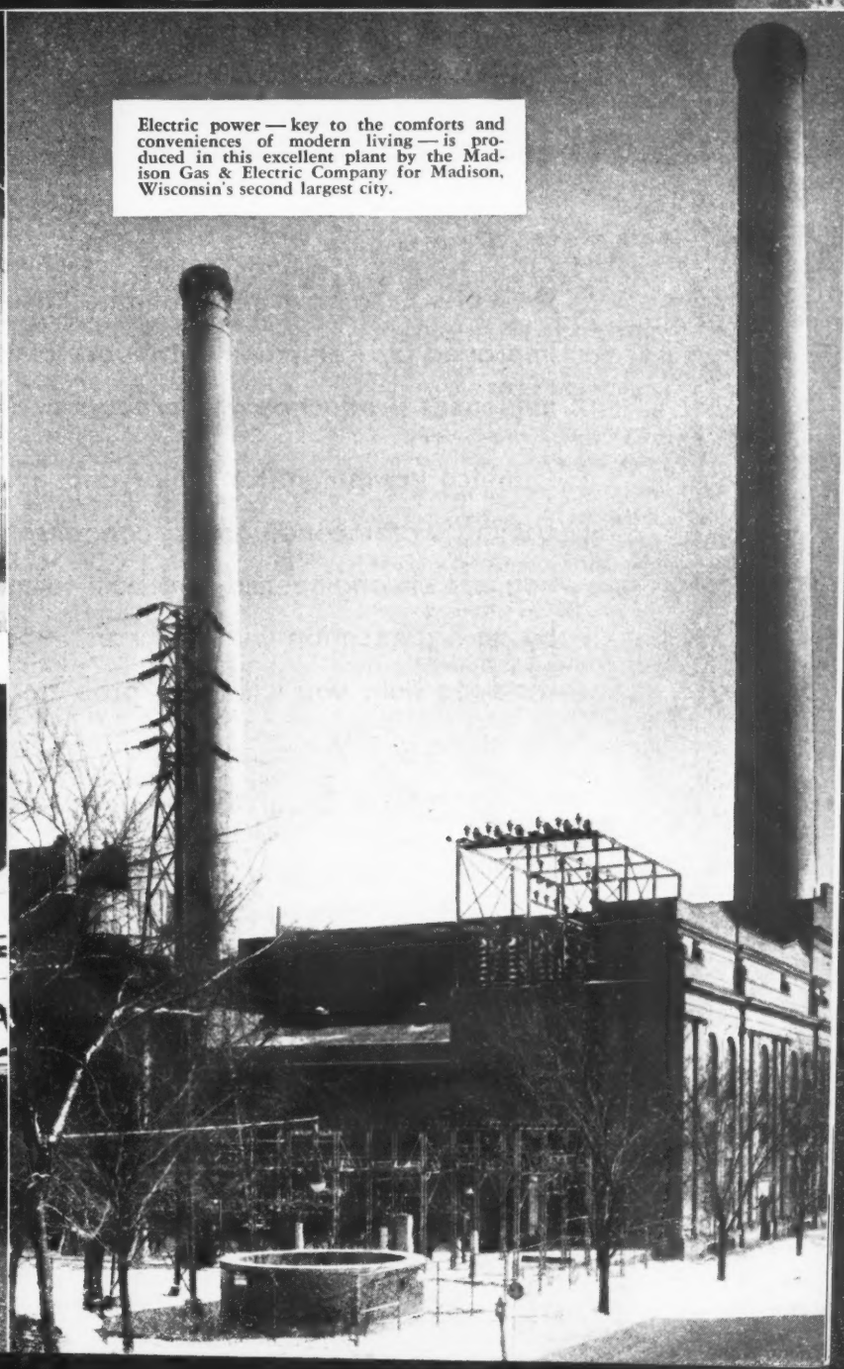
OF THE MADISON GAS & ELECTRIC COMPANY

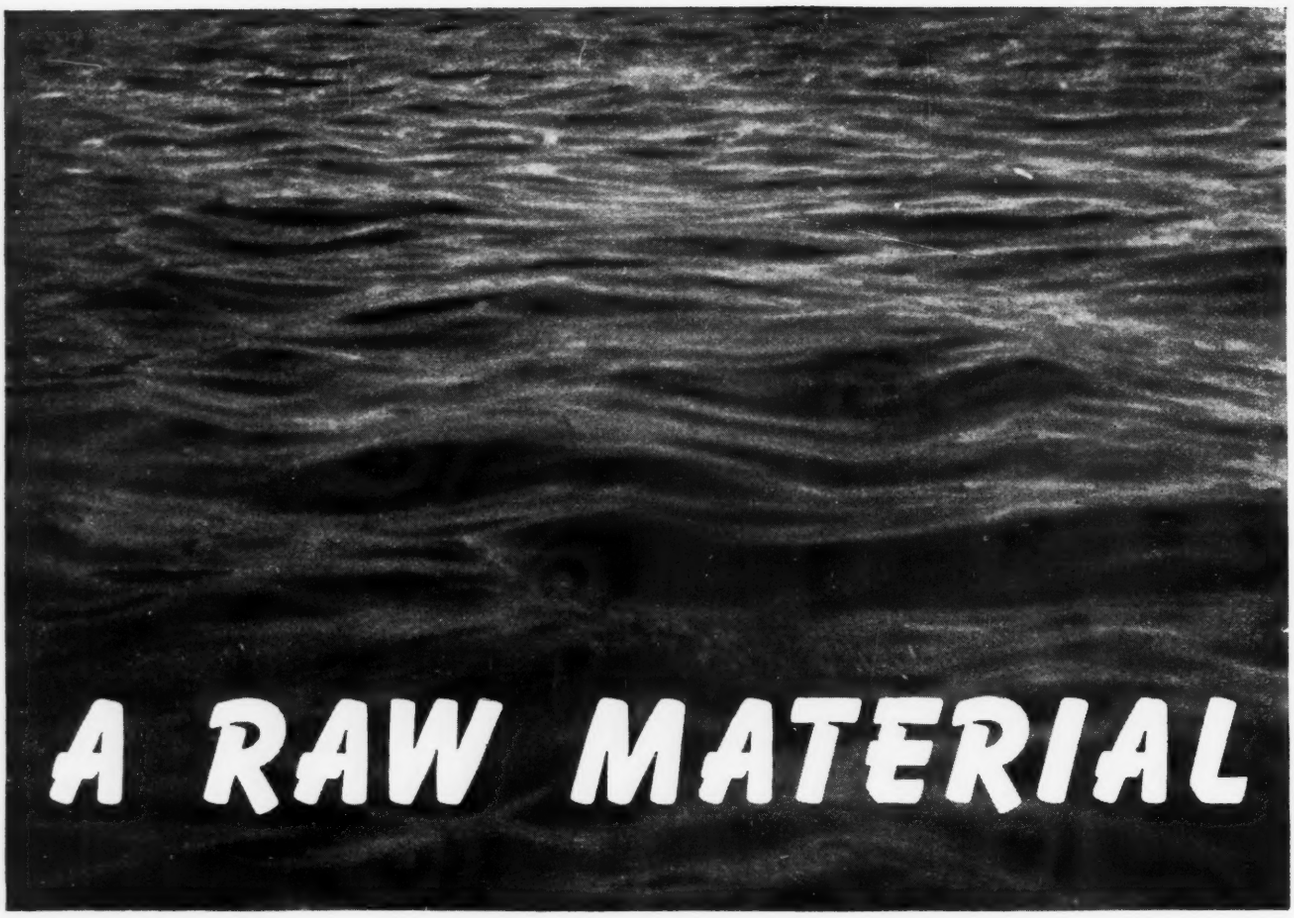
The Madison Gas & Electric Company's Office Building and Display Rooms.



This American Blower Forced Draft Fan is a part of the modern equipment of the Madison Gas & Electric Company power plant.

Electric power — key to the comforts and conveniences of modern living — is produced in this excellent plant by the Madison Gas & Electric Company for Madison, Wisconsin's second largest city.





● Water is a raw material and to use it "as is," when it can be improved by treatment, is to work at low efficiency insofar as water influences production, the process and the product.

Infilco equipment for boiler and evaporator feedwater treatment, cooling water conditioning, condensate oil removal, steam purification, etc., is engineered and built to meet your specific requirements by an organization with 48 years experience. Infilco's staff is always ready to help you with your problems.

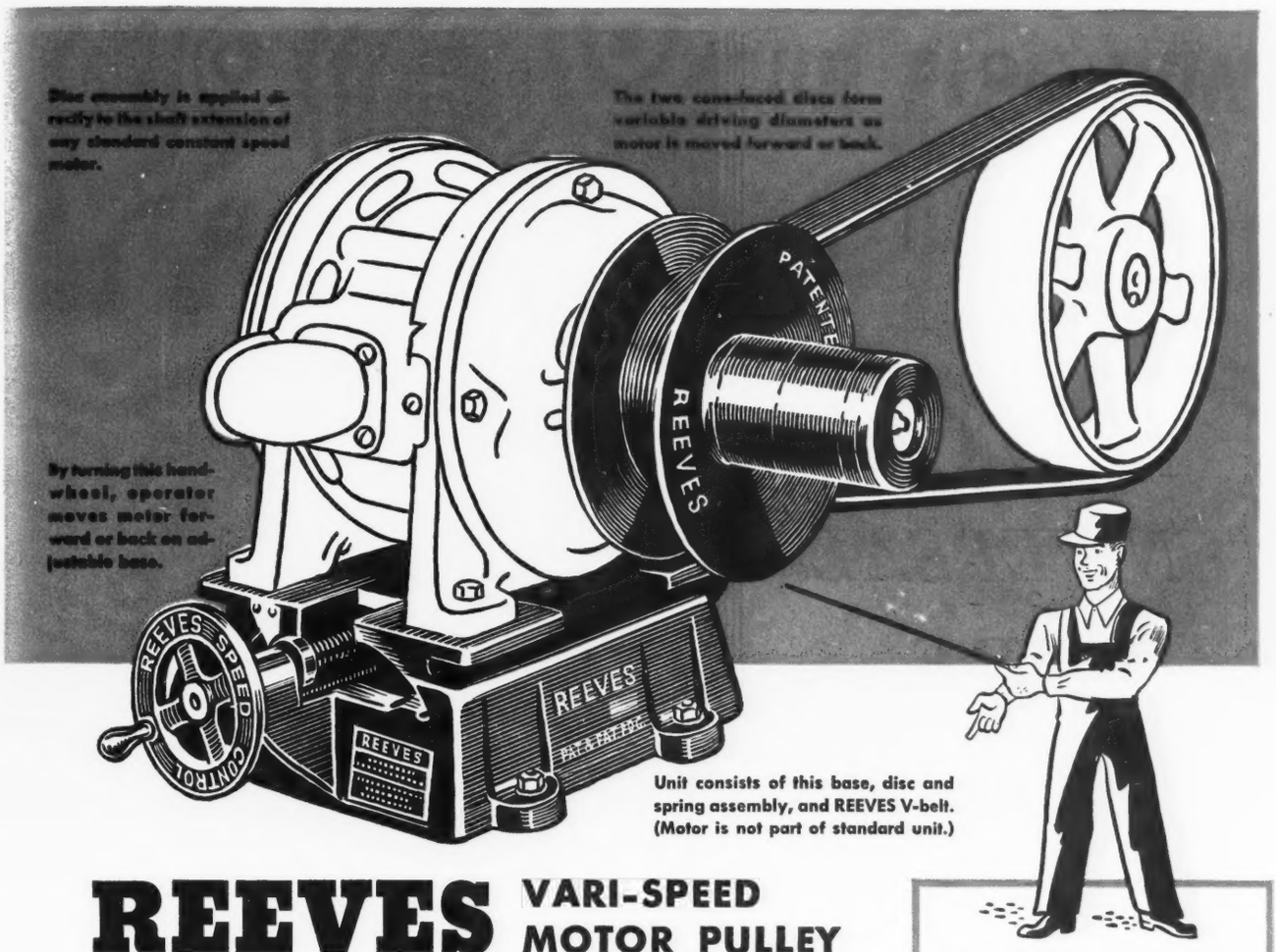
INFILCO
INCORPORATED

325 W. 25TH PLACE, CHICAGO, ILL.
Formerly **INTERNATIONAL FILTER CO.**

INFILCO

ACCELATOR SOFTENERS • CHEMICAL FEEDERS • PROPORTIONERS
WATER FILTERS • CLARIFIERS • COOLING WATER CONDITIONERS
CONDENSATE FILTERS • STEAM PURIFIERS • HOT-FLOW SOFTENERS
LIME-SODA SOFTENERS • ZEOLITE SOFTENERS • CATEXERS

INFILCO

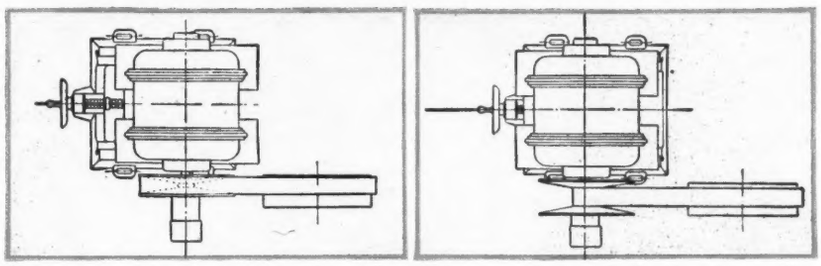

Disc assembly is applied directly to the shaft extension of any standard constant speed motor.
The two cone-faced discs form variable driving diameters as motor is moved forward or back.
By turning this handwheel, operator moves motor forward or back on adjustable base.
REEVES SPEED CONTROL
REEVES
REEVES
REEVES
PATENTED

Unit consists of this base, disc and spring assembly, and REEVES V-belt. (Motor is not part of standard unit.)

REEVES VARI-SPEED MOTOR PULLEY

Two cone-faced discs are mounted on the standard motor shaft extension. Motor is mounted on adjustable base. Through handwheel control, motor is moved forward or back, varying depth of throat between discs. A REEVES V-belt, running between discs and connected to driven machinery, is kept under constant tension by a compression spring. As depth of throat is varied, V-belt assumes different diameters of contact against discs. Speed adjustments are infinite between the limits, and are made while equipment is running. Constant torque; variable horsepower.

REEVES OPERATING PRINCIPLE THAT GIVES PRODUCTION MACHINES "FIGHTING SPEEDS"



Maximum speed—motor nearest to driven pulley Minimum speed—motor farthest from driven pulley

THESE VITAL ADVANTAGES for War Production

FULL-RANGE SPEED ADJUSTABILITY: Not just steps in speed, but *any* speed—to meet changes in size, shape, periphery or type of work.

NO WASTE IN TIME OR MATERIALS: Speed can be adjusted to skill of workers, to prevent waste and spoilage. Speed changes made without stopping driven machine. Valuable aid to new workers.

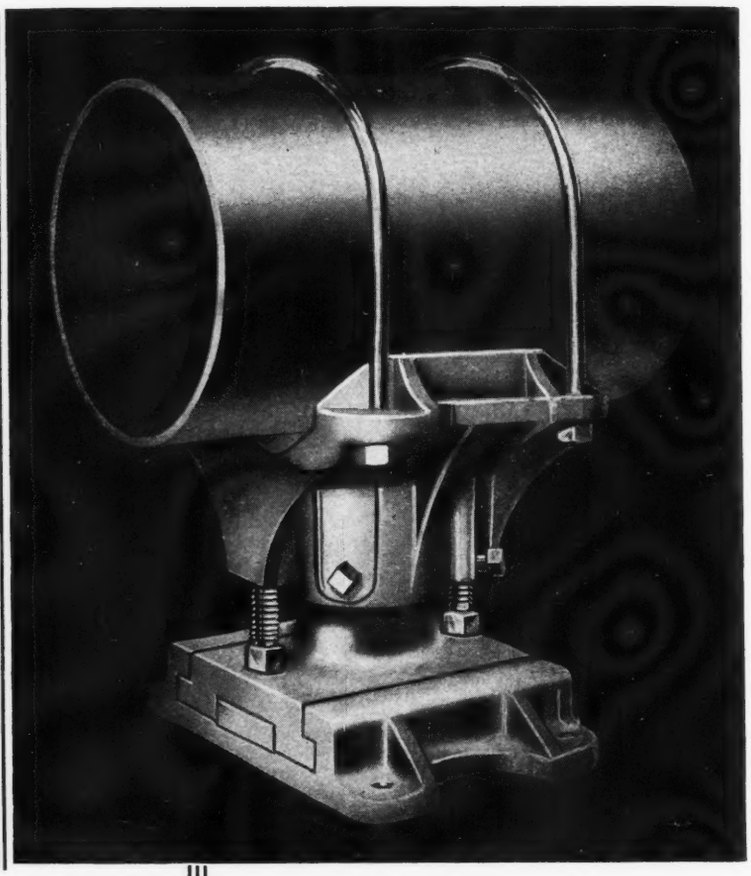
OPERATING PRINCIPLE PROVED in 210,000 installations, including use as standard equipment on 1,440 different makes of machines.

NATION-WIDE ENGINEERING SERVICE: REEVES engineers in 36 leading industrial centers will help you choose the proper unit and apply it correctly.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES Accurate Variable Speed Control

NAVCO *"UNIVERSAL"* PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

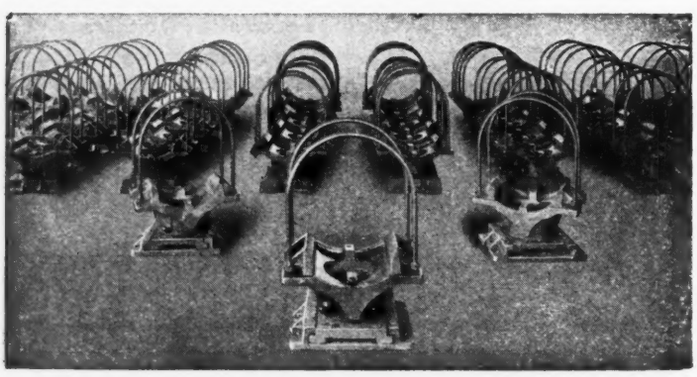
Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

It permits control of expansion movement of pipe and insures the desired free action of the Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

Navco University pipe supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

A recent shipment of "Universals" for high Pressure Central Station Service.



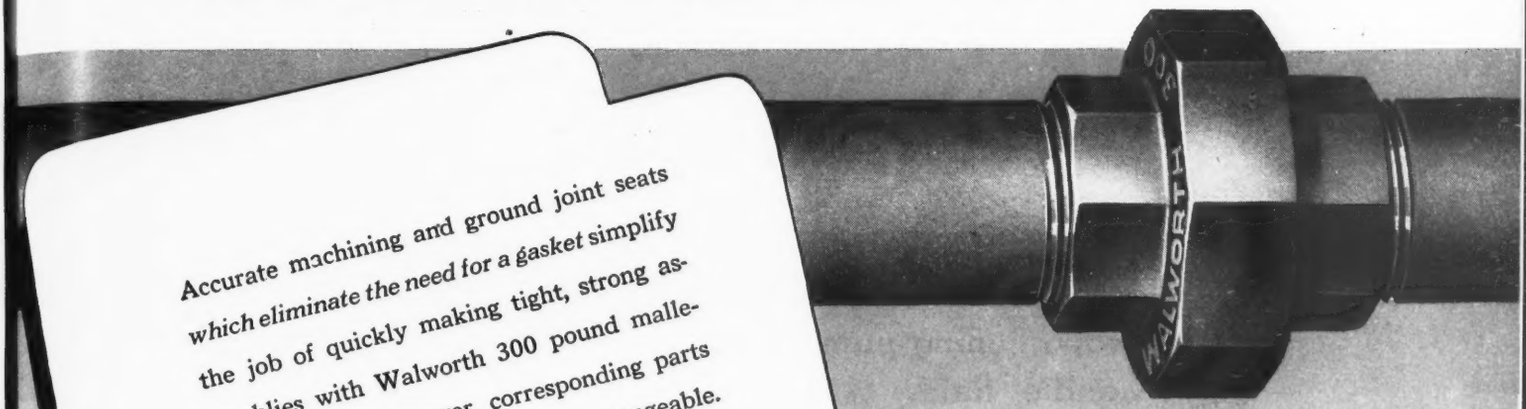
NAVCO POWER PLANT PIPING

Navco Shops are equipped to furnish a complete power piping service, from field measurements to finished installations.

NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA

Simplify YOUR PIPE RUNS WITH WALWORTH UNIONS

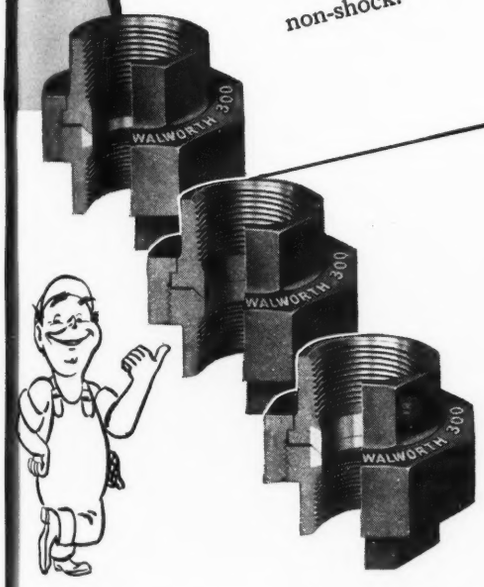


Accurate machining and ground joint seats which eliminate the need for a gasket simplify the job of quickly making tight, strong assemblies with Walworth 300 pound malleable unions. Moreover, corresponding parts of each type of union are interchangeable. They are recommended for steam, oil, water, gas and air lines. Their rugged construction makes them suitable for 300 pounds steam at 550° F.; 600 pounds cold oil, water or gas non-shock.

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH ANNIVERSARY

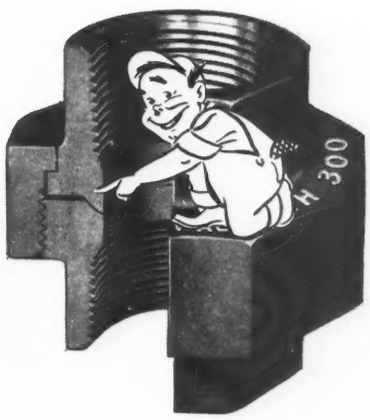
THIS IS OUR CENTENNIAL YEAR

This advertisement continues Walworth's effort to help users of valves, fittings, flanges, and pipe, obtain the maximum benefits from Walworth products, but we would like you to remember that *Walworth has continuously manufactured valves and fittings for 100 years.*



SEAT CONSTRUCTION of these Walworth Unions is of three types: Fig. 7716 bronze to iron seat, Fig. 7227 all iron seat, Fig. 7717 bronze to bronze seat.

BRONZE SEAT UNIONS have non-corrosive seating surfaces. The bronze rings are forced into the retaining grooves under high pressure and will not loosen in service.



GROUND JOINTS are a feature of all these Walworth 300 pound malleable unions, and hence no gasket is needed. The unions can be taken apart and reassembled without affecting their strength and tightness.

WALWORTH

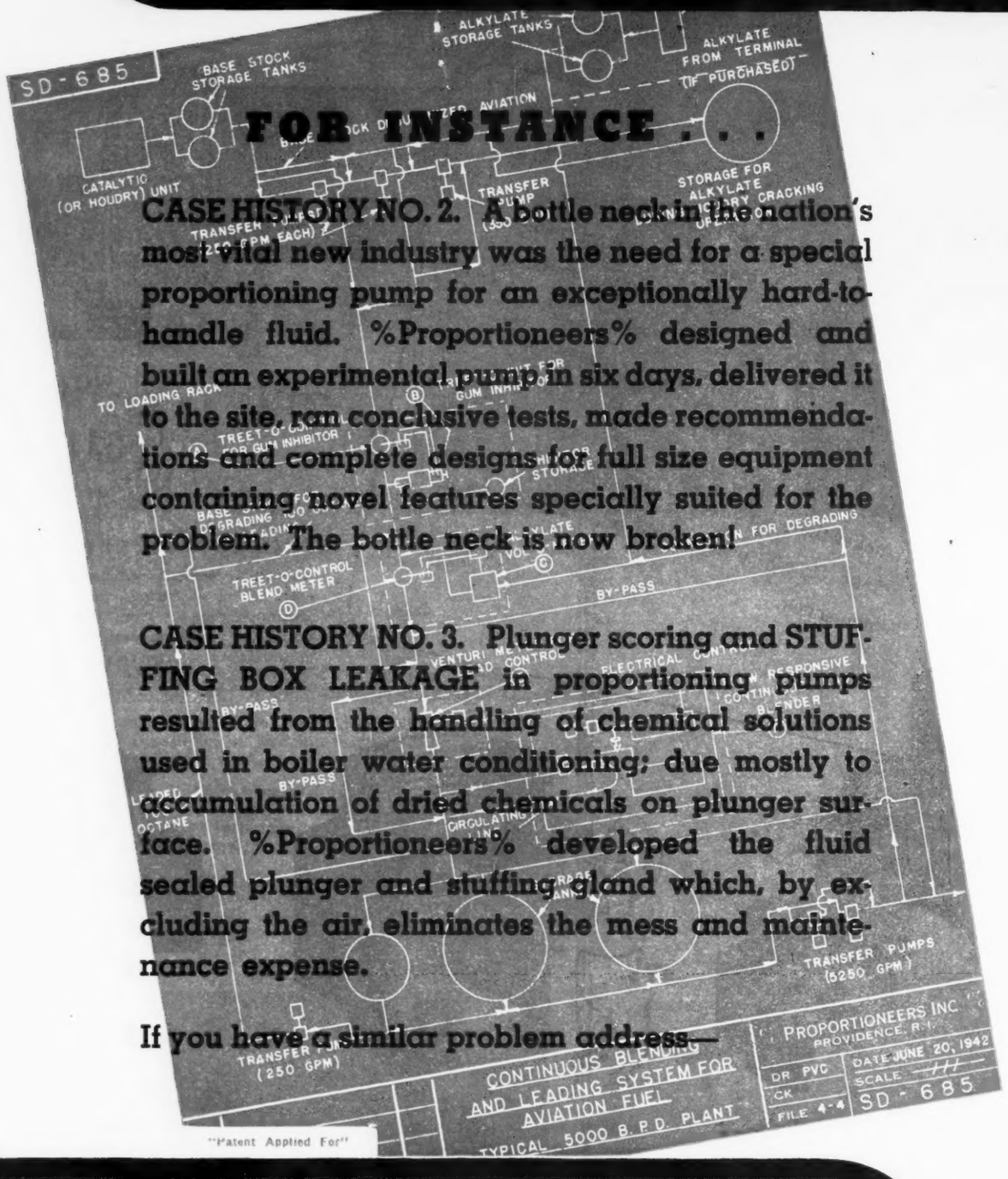
VALVES FITTINGS and TOOLS Backed by 100 Years' Service

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

% PROPORTIONEERS %

SPECIALIZED ENGINEERING
ON PROPORTIONING PROBLEMS



FOR INSTANCE . . .

CASE HISTORY NO. 2. A bottle neck in the nation's most vital new industry was the need for a special proportioning pump for an exceptionally hard-to-handle fluid. %Proportioneers% designed and built an experimental pump in six days, delivered it to the site, ran conclusive tests, made recommendations and complete designs for full size equipment containing novel features specially suited for the problem. The bottle neck is now broken!

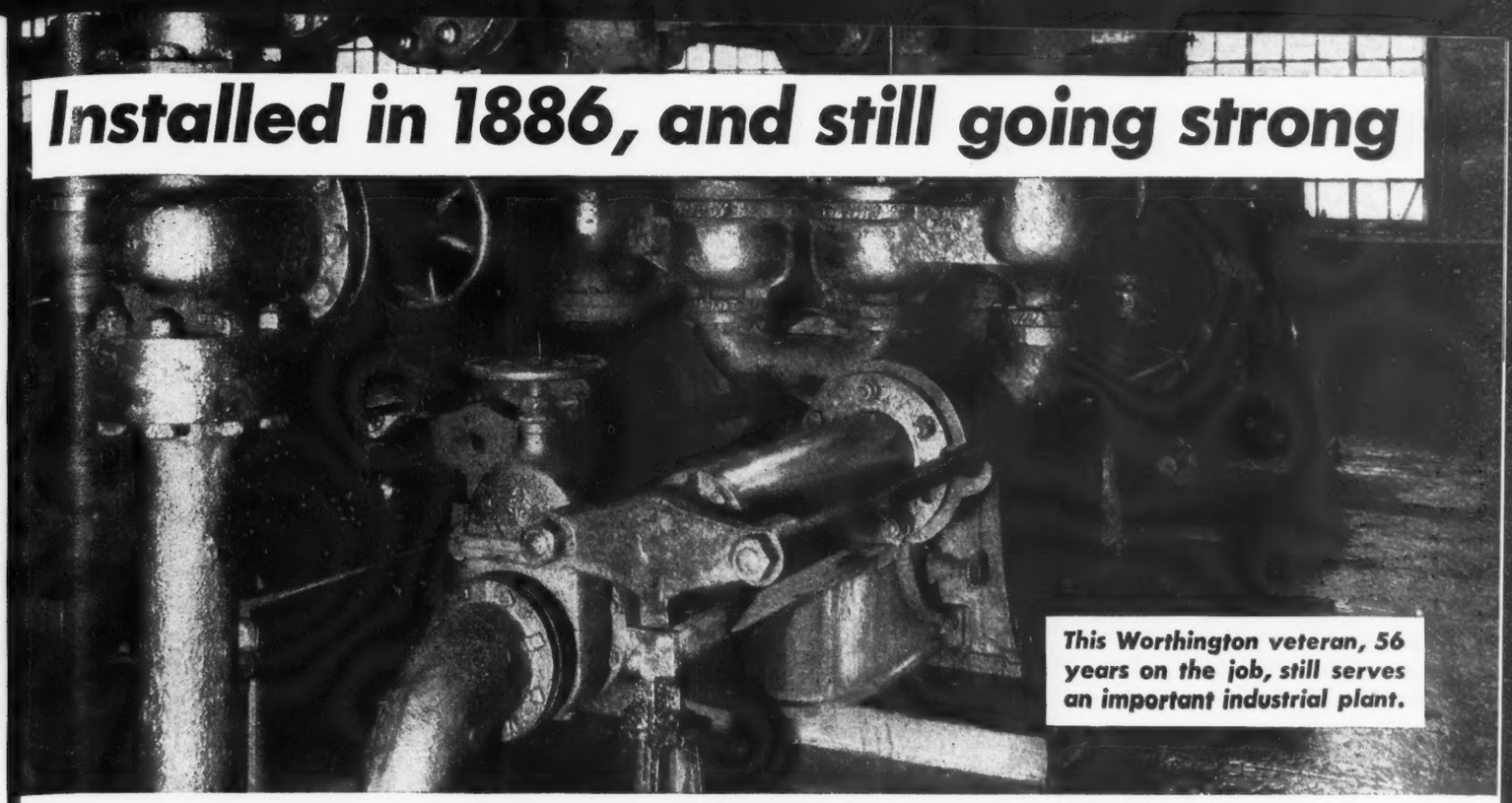
CASE HISTORY NO. 3. Plunger scoring and STUFFING BOX LEAKAGE in proportioning pumps resulted from the handling of chemical solutions used in boiler water conditioning; due mostly to accumulation of dried chemicals on plunger surface. %Proportioneers% developed the fluid sealed plunger and stuffing gland which, by excluding the air, eliminates the mess and maintenance expense.

If you have a similar problem address—

% PROPORTIONEERS, INC. %

16 CODDING STREET, PROVIDENCE, R. I.

Installed in 1886, and still going strong



This Worthington veteran, 56 years on the job, still serves an important industrial plant.

Careful Maintenance Will Keep YOUR Steam Pumps On the Job

YOU long-time users of Worthington steam pumps know how to keep them running and out of your years of experience have come many valuable suggestions. But, under war conditions, many of these pumps may be in the hands of inexperienced operators. These men need some simple practical guidance. Here it is.

Pointers On Steam Pump Maintenance

1. *When starting a pump,* make sure that valves in exhaust, suction, and discharge lines, and all steam end drain valves are open before opening the steam valve. If pump is started cold, crack the steam valve open only enough to heat the steam end, before attempting to run the pump. By allowing drain valves to remain open until the pump has made a few strokes, all condensation will be thoroughly drained off. If this is not done, serious damage to the main steam valves can result.

2. *Lubricate all bearings, joints, moving parts, and piston rods* before starting,—subsequently at intervals when in operation. Lubrication should be frequent, but not so abundant as to gum or clog joints. Use only a good quality of mineral oil in the steam cylinder, and a lighter grade of good mineral (or animal) oil on the valve gear.

3. *Most pump troubles are due to fouled liquid cylinders,* worn valves, or to conditions in the liquid pipe connections outside of the liquid cylinders. If, therefore, the pump begins to perform poorly it is possible that the trouble is in the liquid end. No adjustments should be made on the steam end until a thorough investigation shows that the liquid end is in good working order.

4. *Liquid piston packing should be inspected frequently* to see that it is in good working order.

5. *Liquid valves should get occasional inspection.* If of metal, they should be re-ground when worn.

6. *Keep the stuffing boxes well filled with a good quality of rod packing.* If old packing is allowed to remain in the stuffing boxes long enough to become hard, it will score the piston rod. Do not screw up the stuffing box glands too tight, as too much pressure will damage the packing and make it bind on the rod, causing scoring. An occasional drip from the stuffing box should be allowed, as this shows that the packing is not too tight and, in addition, the small leakage will lubricate the packing.

7. *A suction strainer,* four to five times the area of the suction pipe, should always be used when the liquid contains foreign matter that might clog valves and pump passages. It should be located where it can be frequently inspected and cleaned.

8. *If the pump is to be left idle* for some time, fill lubricator with oil and open lubricator cock so that oil can flow into the steam chest. Let pump make about six quick strokes to distribute the oil evenly over the inside of the steam end to eliminate danger of rusting. In cold weather, open all drip cocks, and drain all piping when pump is not in use, to prevent freezing.

If you want these *Pointers On Steam Pump Maintenance* printed in larger type on a large card, ask our nearest* district office, or address us at headquarters.

*District Offices in All Principal Cities

WORTHINGTON

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

100% AUTOMATIC

STEAM PRODUCTION... *Always*

Out in Cedar Rapids, Iowa, Askania went to work for the Iowa Electric Light and Power Company in 1937. The job was to provide 100% Automatic Control on the first two units of 300,000 lbs. steam capacity. This included complete control of hydraulic couplings. Since then two similar units have been added . . . also Askania equipped.

Now plans call for the installation of units five, six, seven and eight . . . and these also will be Askania equipped! Isn't the answer obvious?

★

A bulletin describing the advantages of Askania's Jet Pipe Principle as applied to Automatic Control of Steam Generating Units is available. Address, Askania Regulator Co., Corner 16th and Michigan Ave., Chicago.

ASKANIA
REGULATOR CO. CHICAGO
AUTOMATIC CONTROL

RUST CLOSING IN ON YOUR TURBINES?

DON'T wait for rust to stop your turbines. It's far less costly to drain, flush and refill with new Shell Turbo Oil. Act now! You'll find new, tested and service-proved Shell Turbo Oil meets all 3 requirements of modern turbine lubrication:

RUST PREVENTION
SUPERIOR OXIDATION STABILITY
MINIMUM FOAMING TENDENCY

Don't accept less! Call in Shell now!

SHELL

Protect your turbines with RUST-PREVENTIVE

SHELL TURBO OIL

"NOW THAT WE HAVE THIS PRIORITY, HERE'S THE LIST OF KENNEDY VALVES WE WANT"

This is the scene in plants all over the country—many of them in your own vicinity. Engineers who have used Kennedy Valves and Pipe Fittings—and those who have learned about the special advantages of Kennedy designs from the new Kennedy Catalog—seek to obtain as many of these popular products as permitted by the defense program and their priorities. It will pay you to investigate. Write for the 240-page Kennedy Catalog.

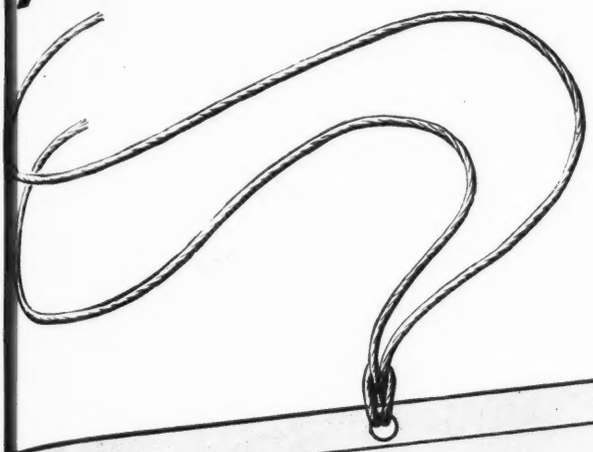
Kennedy Products include complete lines of iron-body and bronze gate, globe, angle and check valves for all standard pressures; and also bronze and malleable iron screwed fittings and cast iron flanged fittings and flanges.

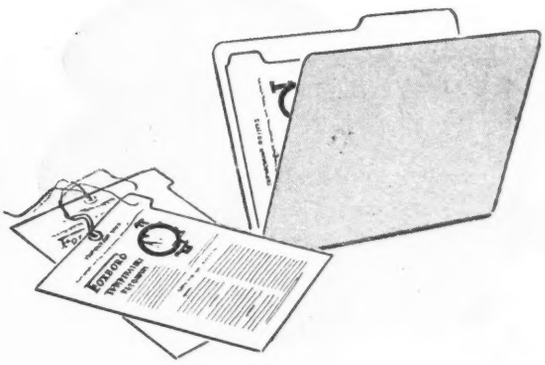
THE KENNEDY VALVE MFG. CO.
ELMIRA • NEW YORK

KENNEDY *valves... pipe fittings... fire hydrants*

Now A QUICK-CHECK SYSTEM

...to keep your instruments in tip-top shape for War Production!



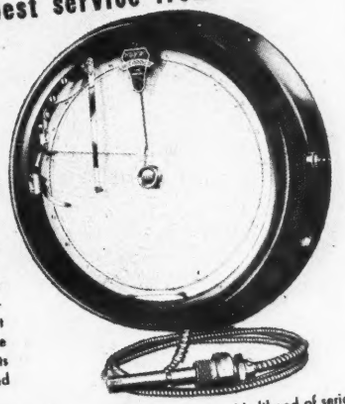


TEMPERATURE RECORDERS

IMPORTANT POINTS
to get longer life, best service from

FOXBORO
REG. U. S. PAT. OFF.

TEMPERATURE RECORDERS



Now, more than ever, it is important to prolong the life of your Temperature Recorders and keep them operating continuously. With very simple care these instruments can be maintained to give continuous, accurate service almost indefinitely without repairs or replacements. Observance of a few simple rules and regular periodic checkups of the points listed below will assure maximum performance and trouble-free service.

Review the installation and maintenance instructions furnished with your Recorder. If the instruction book has been mislaid, send for another one, giving the instrument serial number.

Keep in Mind The Following Points

- Temperature instruments operate by expansion and contraction of gas or liquid in a sealed thermal system extending continuously from the bulb to the instrument. The slightest damage to this system may mean major repairs which may not be available under present conditions. Warn all workmen, especially electricians, who may have occasion to work around the instrument, that the capillary tubing should never be cut or broken. The tubing or bulb should never be used to carry or support the instrument.
- When the instrument is out of service for any length of time, (1) remove all ink from the pens, (2) shut off electric power supplied to the instrument.
- If the instrument service is changed, check the application very carefully, especially as regards corrosion. Check the data plate of the instrument to avoid overranging and damaging the instrument.
- A spring chart drive should be lubricated every year or two, depending on the temperature to which it is subjected. Return the clock to The Foxboro Company or consult the instrument instructions.

If your checkup shows any likelihood of serious trouble, a Foxboro Engineer will be glad to help correct it. There is a Foxboro service office near you.

Check These Points Now

- Can the instrument be relocated to advantage? Install it in a cool location and one as free as possible from vibration, corrosive fumes and vapors.
- Check the installation of the connecting tubing between bulb and instrument. Be sure there are no loose loops that might be caught and damaged by passers-by. Remove carefully any sharp kinks in the tubing.
- Examine the protection tubing for damage. Use acid-proof paint where substitute metal must meet corrosive service. If the protection tubing is damaged, repair it with tape to protect it from further damage.
- Examine the bulb socket — it is there to protect the bulb. If it is badly corroded, replace it with a new socket. This will save destruction of the bulb which would mean a major repair that may not be obtainable in wartime.
- Check bulb for signs of corrosion. Sometimes plating or coating with corrosion-resistant paints will prolong the bulb life. Consider also the use of a socket.

IF IN DOUBT, CALL A FOXBORO ENGINEER

THE FOXBORO COMPANY · FOXBORO, MASS., U. S. A.
Branches in principal cities of the U. S. and Canada

Without modern automatic measurement and control instruments, war plants could not maintain today's high quality and volume of production *for a single day!* It's vitally important to keep every instrument in your plant operating at top efficiency for the duration!

To help you, Foxboro has developed a complete Quick-Check System for putting your instrument maintenance on an easy, accurate routine. There are separate 9"x11" Quick-Check Cards, like the example illustrated, for the principal Foxboro Instruments in your plant.

Attached to your installations or handily filed, these A-B-C instruction cards give simple, clear directions for all essential maintenance steps . . . enable even new-trained instrument men to prevent interruptions in the valuable services Foxboro Instruments render.

Write for Quick-Check Cards for your plant, specifying all types of Foxboro Instruments you use. Supplied without charge. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities.

FOXBORO
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Recording · Controlling · Indicating Instruments

COMMANDOS
OF
Water Conditioning

THE CHEMIST
THE CHEMICAL ENGINEER
THE MECHANICAL ENGINEER

. . . their coordinated efforts spell VICTORY over *all* Water Problems

The Bird-Archer Co. is a balanced organization of Chemists, Chemical Engineers, and Mechanical Engineers—at your service—for the satisfactory solution of all water problems.

SURVEYS · PLANT STUDIES · CONSULTATIONS · TREATMENTS

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Scientific Water Conditioning
SINCE 1885

New York, N. Y.
400 Madison Ave.
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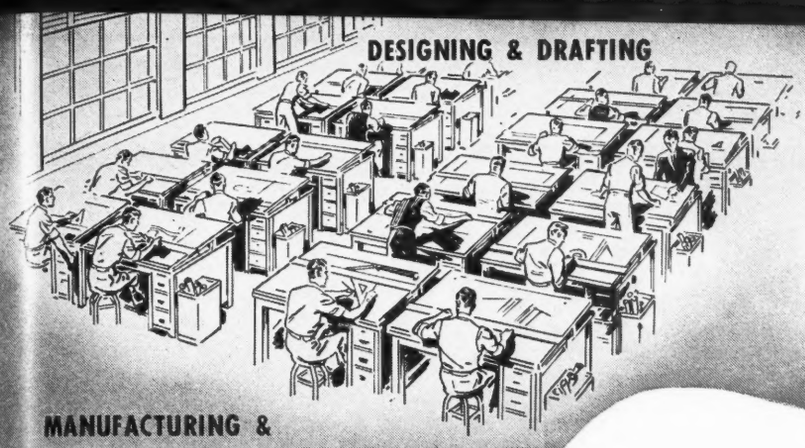
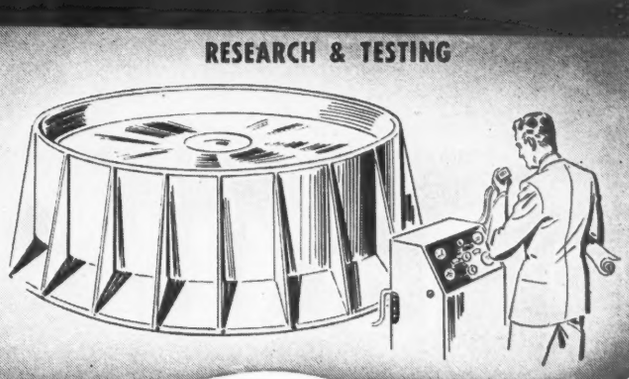
THE BIRD-ARCHER CO. LTD. • McGILL BUILDING, MONTREAL, CANADA

Photo by ACME





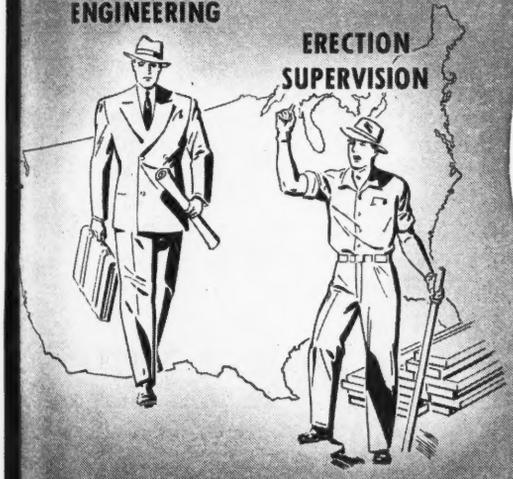
MANUFACTURING & STOCK AT TWO PLANTS

Another PLUS Feature of MARLEY Cooling Towers

is the ORGANIZATION and FACILITIES behind them

SALES & ENGINEERING

ERECTION SUPERVISION



The one Marley "plus" feature which supports all others is the sound, strong organization that, by every comparison, leads its field.

NATION-WIDE SALES and ENGINEERING SERVICE in 36 major industrial centers puts Marley experience conveniently available to all.

TWO LARGE PLANTS prepare parts and sub-assemblies on a line-production basis for stock and/or prompt shipment.

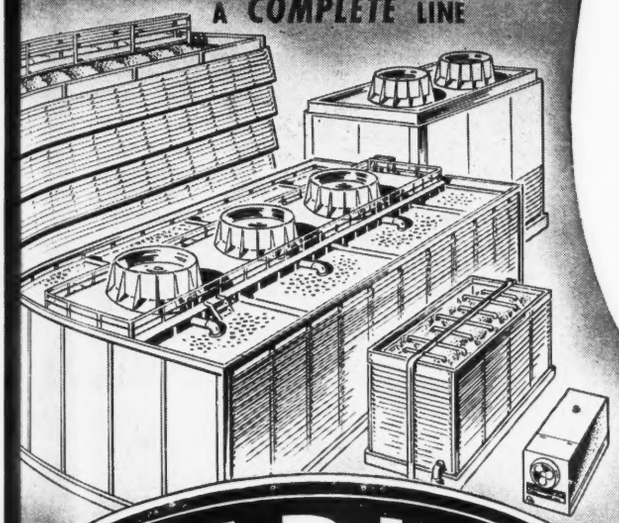
EXPERIENCED ERECTION SUPERVISORS assure fast, skilled assembly in the field by capable crews.

DESIGNING and DRAFTING is directed by a veteran engineering staff. Every installation is carefully adapted to the exact needs of the specific application. Yet standardized details and design achieve production and erection economies that mean greater values—towers that are structurally sound with a high ratio of efficiency to size.

RESEARCH and TESTING is a continuous program, the sole activity of a staff conducting tests in the field, and a main-plant force experimenting with working models of new developments.

A SINGLE OBJECTIVE and A COMPLETE LINE are basic Marley aims: (1) To devote all energies and resources to water cooling only. (2) To serve all applications with utmost efficiency and economy by offering all parts and products in every type and size.

A COMPLETE LINE



One of a series of advertisements, each devoted to a Marley cooling tower feature that has become an accepted standard of the best practice in modern mechanical draft water cooling.

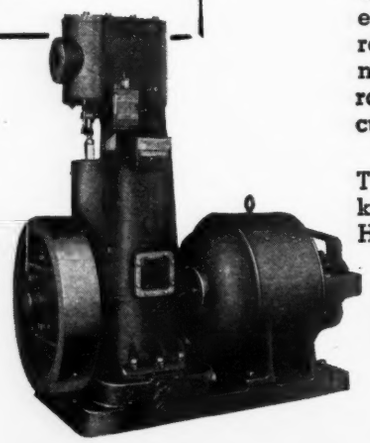
7-42-B

MARLEY COOLING TOWERS

Every MARLEY TOWER *is individually engineered by* THE MARLEY CO., INC. — KANSAS CITY, KANSAS

TROY-ENGBERG

Afloat...on our bridge of Ships



Aboard ships where, for several reasons, the generation of direct current is a "must", it is significant that hundreds of Liberty Ships have been or are being equipped with Troy-Engberg Generating Sets . . . Troy-Engberg Engines driving Troy-Engberg DC Generators.

It is significant but it is not surprising to those who know what's best in auxiliary power equipment. These sets long ago proved their great dependability and high efficiency. They are just what the marine architect and engineer need to round out their auxiliary power requirements.

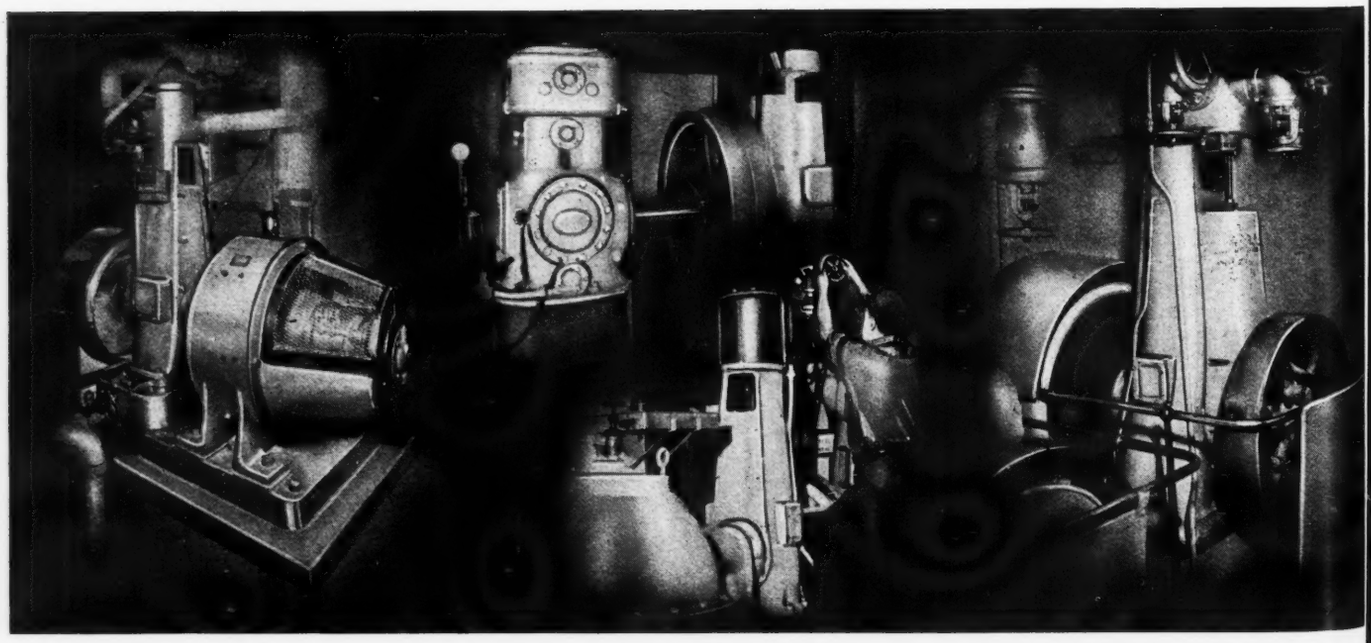
You, in industry, should be interested in the Troy-Engberg Generating Set . . . (1) as the main source of power, if your plant is relatively small; (2) as auxiliary power for week-end, holiday or night loads; or (3) for reducing demand charges. Standard sizes range up to 50 kw. for direct current and 75 kv.a. for alternating current.

• • •

Troy-Engberg Steam Engines are also used aboard ships of all kinds for driving pumps, refrigeration compressors, fans, etc. Horizontal as well as vertical types are available.

TROY ENGINE

Established 1870



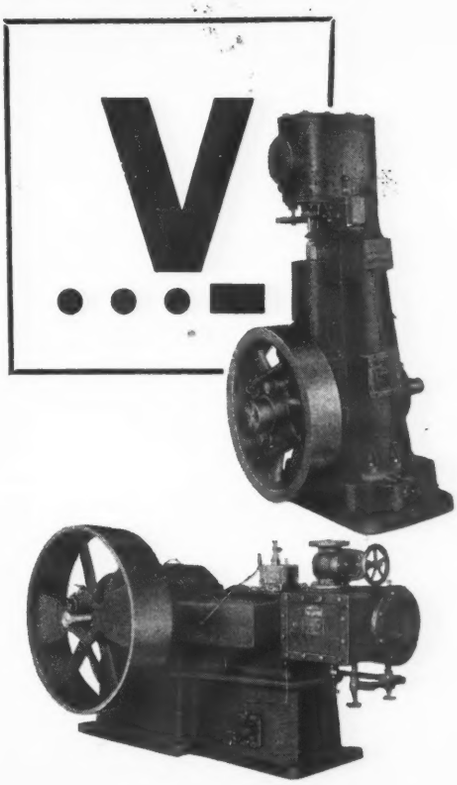
AUXILIARY POWER

Ashore...in countless Factories

In the factory, it's the Troy-Engberg Steam Engine that dominates the picture. One can find hundreds driving fans, compressors, blowers, stokers, pumps, cookers, dryers—and, of course, generators.

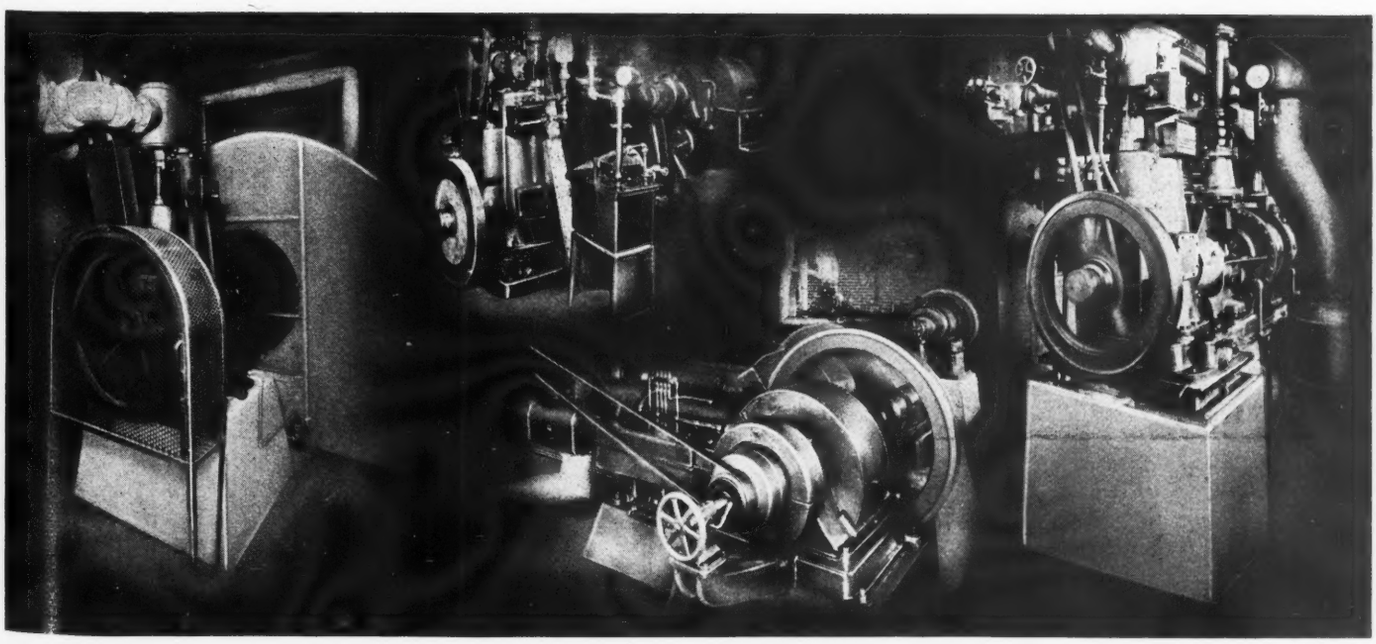
Troy-Engberg Engines are dependable. There's no doubt of this with less to wear or get out of order than in any other prime mover. But they offer numerous other advantages of which economy is by no means the least important. What would you say of an average overall power cost at the drive shaft of ½ cent per kw. h? That's what the Troy-Engberg Steam Engine is showing in a survey made of some forty plants. What would you say if you knew that one of the largest public utilities recently equipped 48 stokers with 24 Troy-Engberg Steam Engines? There was a very definite reason—the engine's superior flexibility. And, so it goes. We could cite many comparable instances.

Dependability, economy and special drive characteristics give the modern Troy-Engberg steam engine a high place among power engineers and production men.



& MACHINE CO.

1481 RAILROAD AVE., TROY, PA.



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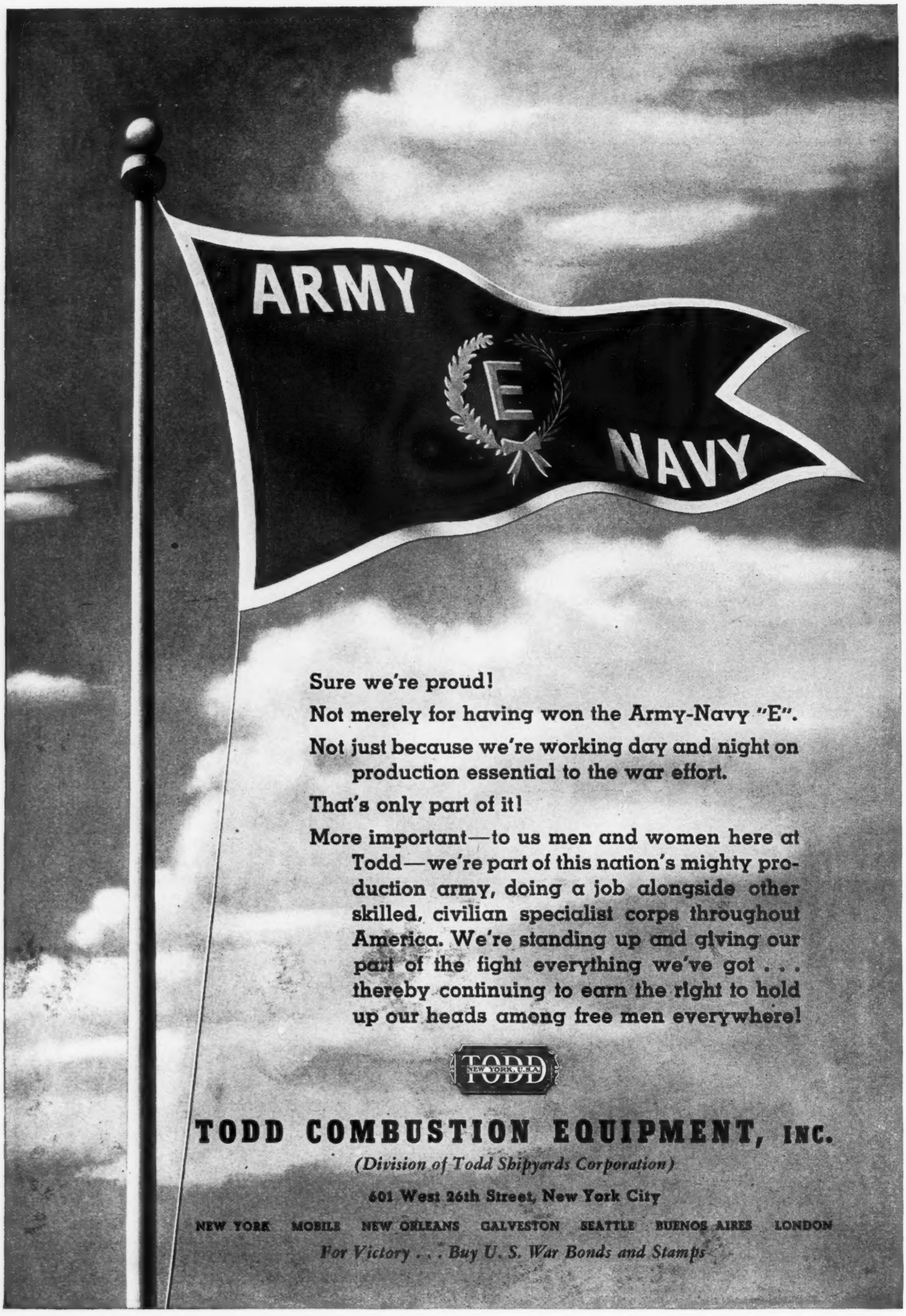


Sure we're proud!

Not merely for having won the Army-Navy "E".

Not just because we're working day and night on production essential to the war effort.

That's only part of it!

More important—to us men and women here at Todd—we're part of this nation's mighty production army, doing a job alongside other skilled, civilian specialist corps throughout America. We're standing up and giving our part of the fight everything we've got . . . thereby continuing to earn the right to hold up our heads among free men everywhere!

TODD
NEW YORK, U.S.A.

TODD COMBUSTION EQUIPMENT, INC.

(Division of Todd Shipyards Corporation)

601 West 26th Street, New York City

NEW YORK MOBILE NEW ORLEANS GALVESTON SEATTLE BUENOS AIRES LONDON

For Victory . . . Buy U. S. War Bonds and Stamps

40% LESS STRESS WITH 38% SAVING IN SPACE

in this PITTSBURGH PIPING CREASED and CORRUGATED PIPING

40% LESS STRESS

Calculations based on using a plain expansion bend 20′ wide and 13′ high show a maximum bending stress of 14800 lbs. per square inch which is excessive. By using Pittsburgh Piping creased and corrugated construction bending stress is reduced to 8000 lbs. per square inch and resultant end reaction drops from 3200 lbs. to 1400 lbs.

38% SAVING IN SPACE

If a plain expansion bend 20′ wide were employed in this assembly, it would be necessary to increase the overall height from 13′ to 21′ to maintain the same bending stress of 8000 lbs. per square inch obtained with the creased and corrugated construction; a saving in space of 38%.

10″ Creased and Corrugated Expansion Bend 13 Ft. High 20 Ft. Wide

Pittsburgh Piping & Equipment Co.

CREASED BENDS WITH CORRUGATED TANGENTS

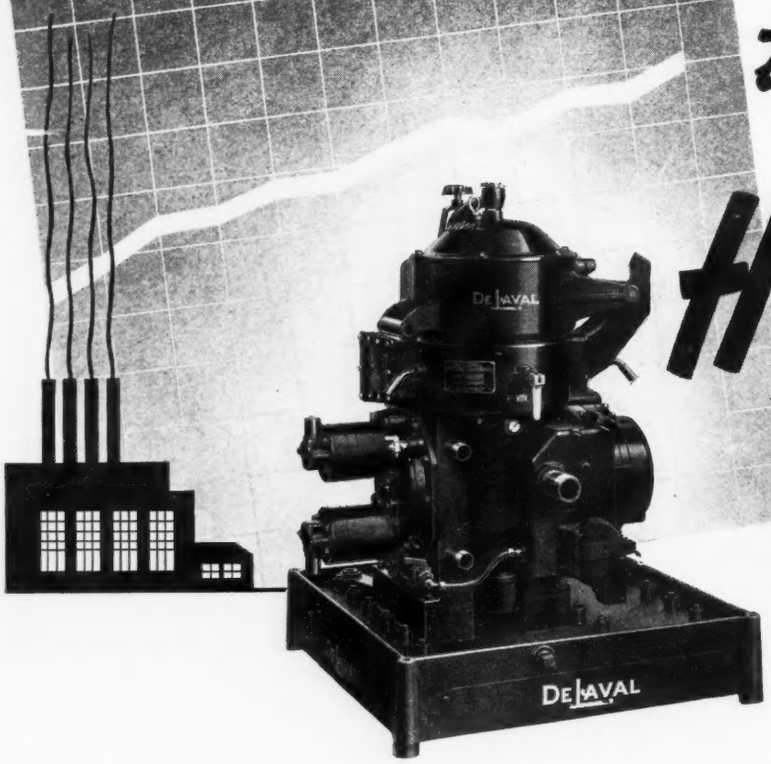
From the comparisons made in the above panels, you can readily see how Pittsburgh Piping Creased Bends and Corrugated Tangents make possible unusual compactness in the design of any piping system. They are particularly valuable when replacing existing piping systems with more complex, high temperature piping in the same building. For complete data about the extraordinary flexibility of this type of piping, write for your copy of "Pittsburgh Piping Design Manual."

PITTSBURGH PIPING & EQUIPMENT CO.

10 FORTY-THIRD STREET PITTSBURGH, PA.

Woolworth Bldg., New York · Occidental Bldg., Indianapolis · Peoples Gas Bldg., Chicago · Union Guardian Bldg., Detroit
Public Sq. Bldg., Cleveland · 10 High St., Boston · 525 Market St., San Francisco

CLEANER LUBRICATING OIL *to withstand* HEAVIER WAR-TIME LOADS



Turbines and Diesel engines working long hours under full load need all the protection that high-grade lubricants can give. But even the best oil cannot give this protection unless it is continuously kept free from all the various types of impurities with which oils inevitably become contaminated in service.

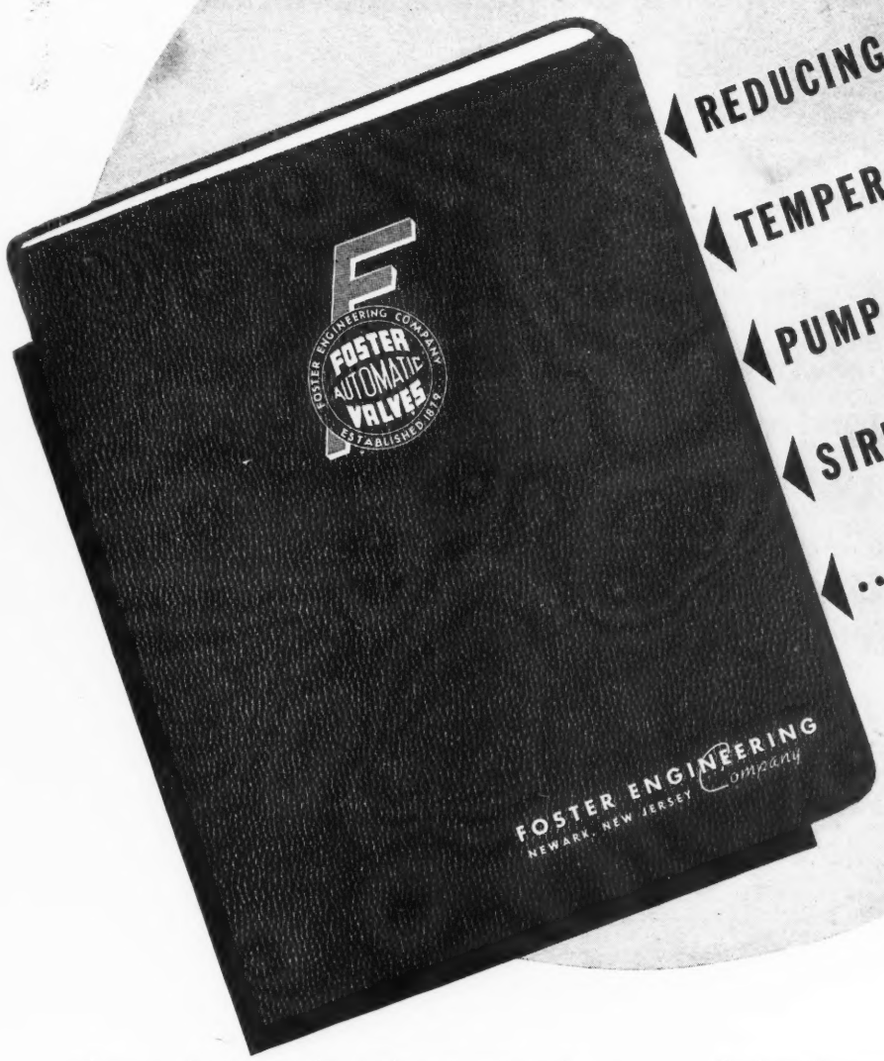
De Laval Oil Purifiers are used in outstanding power plants—a very high percentage of them—to keep oil clean, because they do a thoroughly dependable job in a most economical manner. They save oil, it's true; but, what is more important these days and every day, they save prime movers, keeping them at work for longer periods and reducing maintenance cost.

There is a De Laval Oil Purifier and system for every size and type of power plant. Full details in Bulletin No. 106. In writing, please state your particular problem so that De Laval engineers can be of real help—without obligation, of course.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

DE LAVAL *OIL PURIFIERS*

Here is Your handbook on



- REDUCING VALVES
- TEMPERATURE REGULATORS
- PUMP GOVERNORS
- SIRENS
- ...plus eight sections of useful engineering data

Are you having trouble with automatic valves — ragged regulation, constant cleaning, repeated repairs and replacements?

Have you a regulation or control problem that hasn't been licked — a service that has been "just too much" for the average automatic valve?

There may be a practical and profitable solution to your problem in this new catalog covering one of the most complete lines of automatic valves, for its content is not limited to a mere "sales story".

Such sections as those on application, operation, installation, and inspection, as well as the inclusion of eight complete sections of engineering data, make this catalog virtually a handbook of useful information.

A copy of this catalog will be sent to executives and engineers in those industries that are "all out" for victory if the request is written on their company's letterhead. Simply ask for Catalog 70.

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

106 MONROE STREET • NEWARK, N. J.

WHY NOT USE SMALL IRON VALVES TO CONSERVE BRONZE

Fairbanks improved U-Bolt Gate Valve is designed to meet the demand for an extremely rugged valve at a low cost.

It is especially adapted for the exacting service in the chemical, paper, and petroleum industries, as well as for ordinary steam, water and air lines.

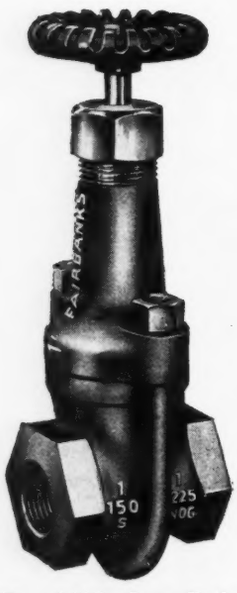


Fig. 0417—Iron Body, Bronze Mounted.
Fig. 0418—All Iron

Simple in design, with but a few parts, it can be taken apart, inspected and cleaned with a minimum of effort and time.

They are made in sizes from 1-2″ to 4″ for 150 lb. steam and 225 lb. liquid pressures, for practically any service where bronze gate valves can be used.

Write for Booklet No. 30 and name of our nearest distributor.

THE FAIRBANKS COMPANY
397 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.

Fairbanks *Standard and* Renewable Valves

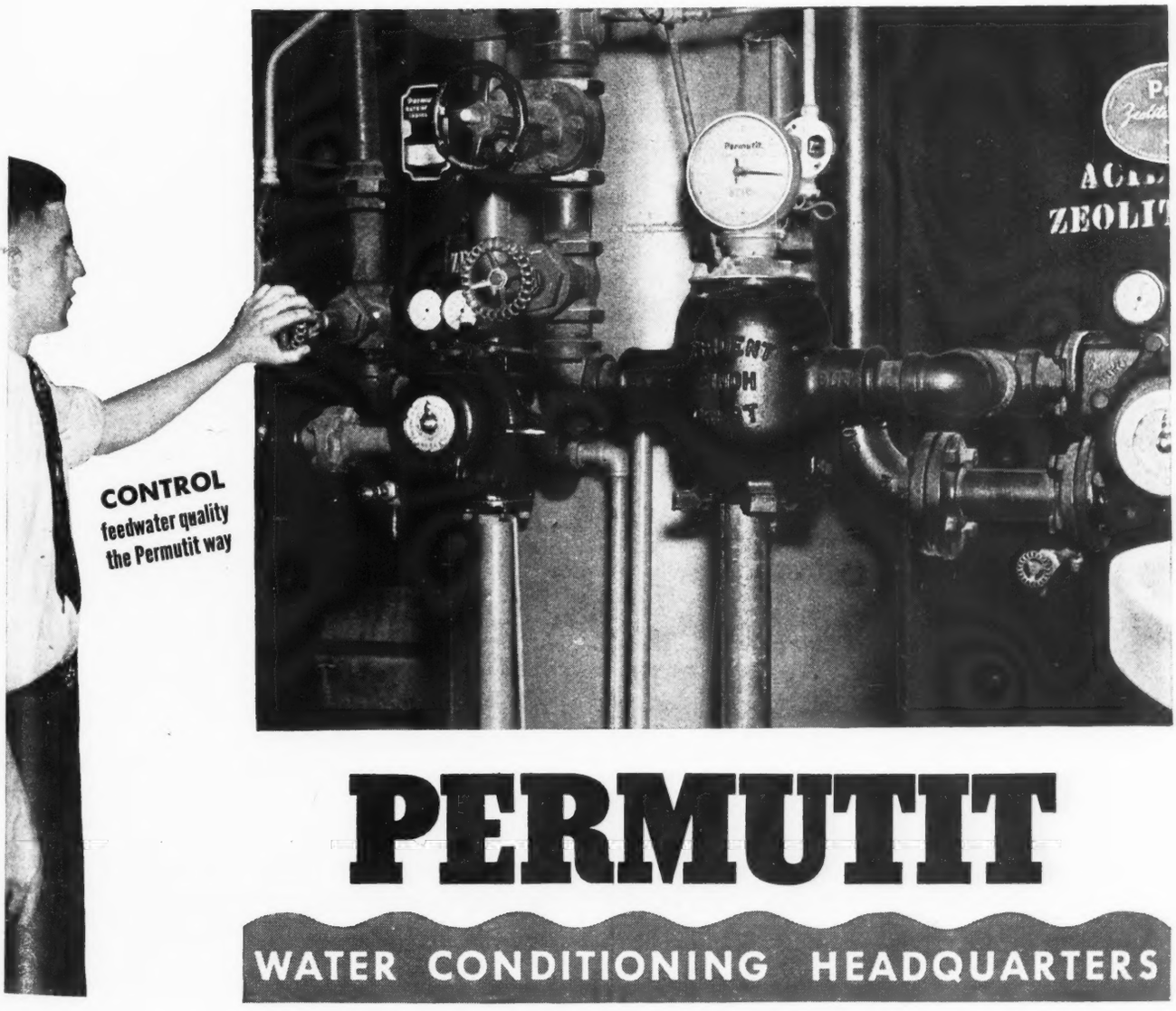
War output demands that your plant, too, should be able to say:

"NO SCALE OR CORROSION AFTER OPERATING A FULL SEASON... BOILERS ARE CLEAN, LIKE NEW METAL"

—ALLENTOWN STEAM HEATING CO.

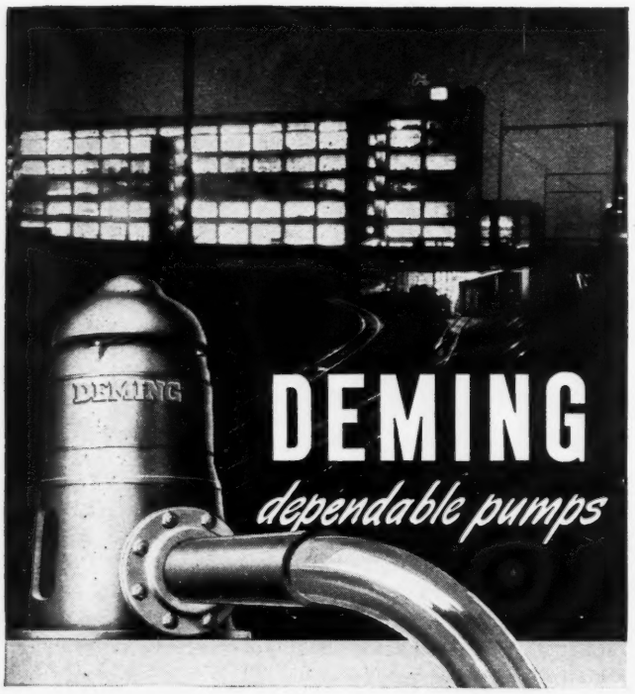
Permutit equipment gives complete protection. To keep delivering full power loads, it's imperative to avoid shutdowns and deterioration of critical equipment. And that calls for feedwater treatment that exactly fits individual needs. For instance, the Allentown Steam Heating Co. was troubled by scale and sludge in boilers, corrosion in return lines. At the suggestion of their consultants, Cyrus Wm. Rice & Co., Inc., they installed Permutit Zeo-Karb* Softeners, Deaerating Heaters and Continuous Blowoff equipment. The result, quoted above, is typical of the protection enjoyed by 10,000 Permutit-equipped plants. Why not bring *your* problem to the world's largest manufacturers of water conditioning equipment: The Permutit Company, Dept. A, 330 West 42nd Street, New York, N.Y. In Canada: Permutit Company of Canada, Ltd. . . Montreal . . Toronto . . Winnipeg . . Calgary.

*TRADEMARK REG. U. S. PAT. OFF.



PERMUTIT

WATER CONDITIONING HEADQUARTERS



FOR "Round-the-Clock WAR PLANT SERVICE

● The War gave Deming Deep Well Turbine Pumps a chance to PROVE their high standards of engineering.

Ready for immediate action at any time during a full 168 hour week, Deming Turbines are vital to continuous water supply in scores of "key" war plants.

Electrical starting and operating equipment makes it possible to run this pump at off-peak periods, thereby reducing current costs.

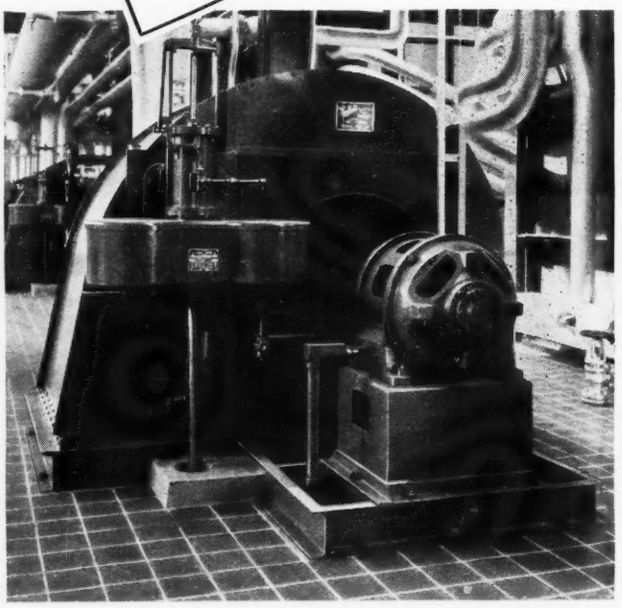
Water lubricated features of Deming Turbines eliminate possibility of water contamination from lubricating oils or grease, as none are required.

Send for illustrated Bulletin 4700-8 which explains graphically the many important features of Deming Deep Well Turbine Pumps.

THE DEMING COMPANY • SALEM, OHIO

DEMING

PUMPS FOR WAR INDUSTRIES



● Power plant operators respect this pledge of Buffalo Mechanical Draft Fans. From long experience, they know that when emergencies call for more and more power, Buffalo Fans answer with prompt, reliable draft to meet peak loads . . . Their extra rigid construction . . . vibration-free rotors . . . practical housing designs — in fact, every Buffalo detail is built to stand the gaff of exacting service. *They're on the job 24-hours-a-day for Victory!*

BUFFALO FORGE COMPANY
448 BROADWAY BUFFALO, N. Y.
Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" MECHANICAL DRAFT FANS

STOP the Leaks in your Valves
KEEP your Valves on the line

...use DEXTER Valve Reseating Equipment

For the past 50 years, the installation of complete Dexter Valve Reseating Equipment has always been the best assurance of having tight valves all the time. Now, when the conservation of power is so vital, and new equipment and parts are so difficult to obtain, this Dexter Equipment is more *necessary* than ever.

Dexter Valve Reseating Equipment can reseat *any* valve of *any* manufacture, of *any* metal. The job can be done by any mechanic without removing the valves from the line. All seats and gates or discs will be pressure tight.

Dexter Valve Reseating Equipment soon pays for itself. Send for complete information — today.

Capacities: Globe Valves, 1/4" to 14"; Gate Valves, 1 1/2" to 48"; Pump Valves, 2" to 15".

DEXTER
Valve Reseating Machines

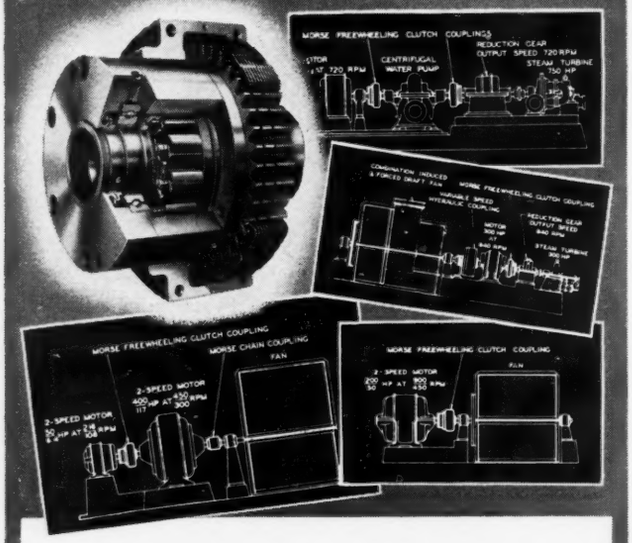
THE LEAVITT MACHINE CO., 110 EAST RIVER STREET, ORANGE, MASSACHUSETTS

MORSE

FREE-WHEELING CLUTCHES

ARE INDISPENSABLE FOR MAXIMUM

DUAL-DRIVE EFFICIENCY

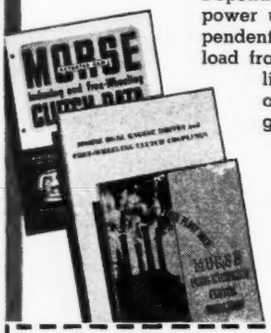


Morse Free-Wheeling Clutches have flexible couplings integrally built into one highly compact free-wheeling clutch unit. They are unsurpassed as an efficient, automatic, dual-drive connecting medium.

Regardless of power units, varying speeds and loads, Morse Free-Wheeling Clutches utilize all the power to an unheard of high degree . . . eliminate cost of manual attention . . . maintain constant speeds and meet all load demands. They automatically engage upon torque application and disengage when torque ceases.

Depending on load demand, either or both power units may simultaneously or independently drive the load. Changeover of load from one to the other power unit is likewise automatic without stopping or retarding speed of load. Investigate now — Morse Free-Wheeling Clutches will pay for themselves many times over in maintenance and power savings.

MORSE CHAIN CO., DETROIT, MICHIGAN, ITHACA, N.Y. • Div. Borg-Warner Corp.



MAIL TODAY

MORSE CHAIN COMPANY, 7601 Central Avenue
Detroit, Michigan

Please send me the latest Morse Dual and Multiple Drive Engineering Data.

Name_____

Company_____

Address_____

City_____ State_____

MORSE FREE WHEELING CLUTCHES

PIPEWRENCH PETE SAYS:

WHOOSH— CLICK . . . they're HOT!

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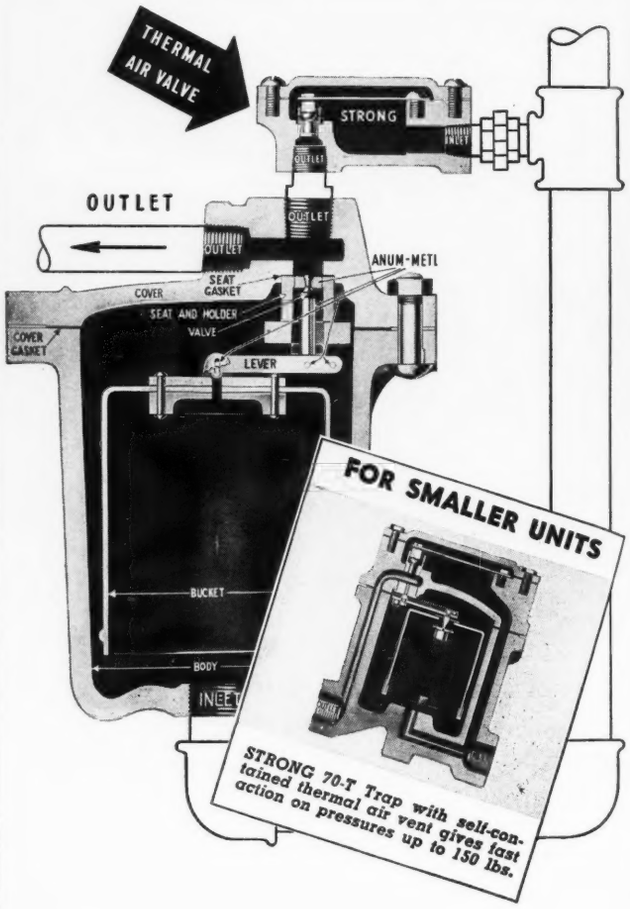

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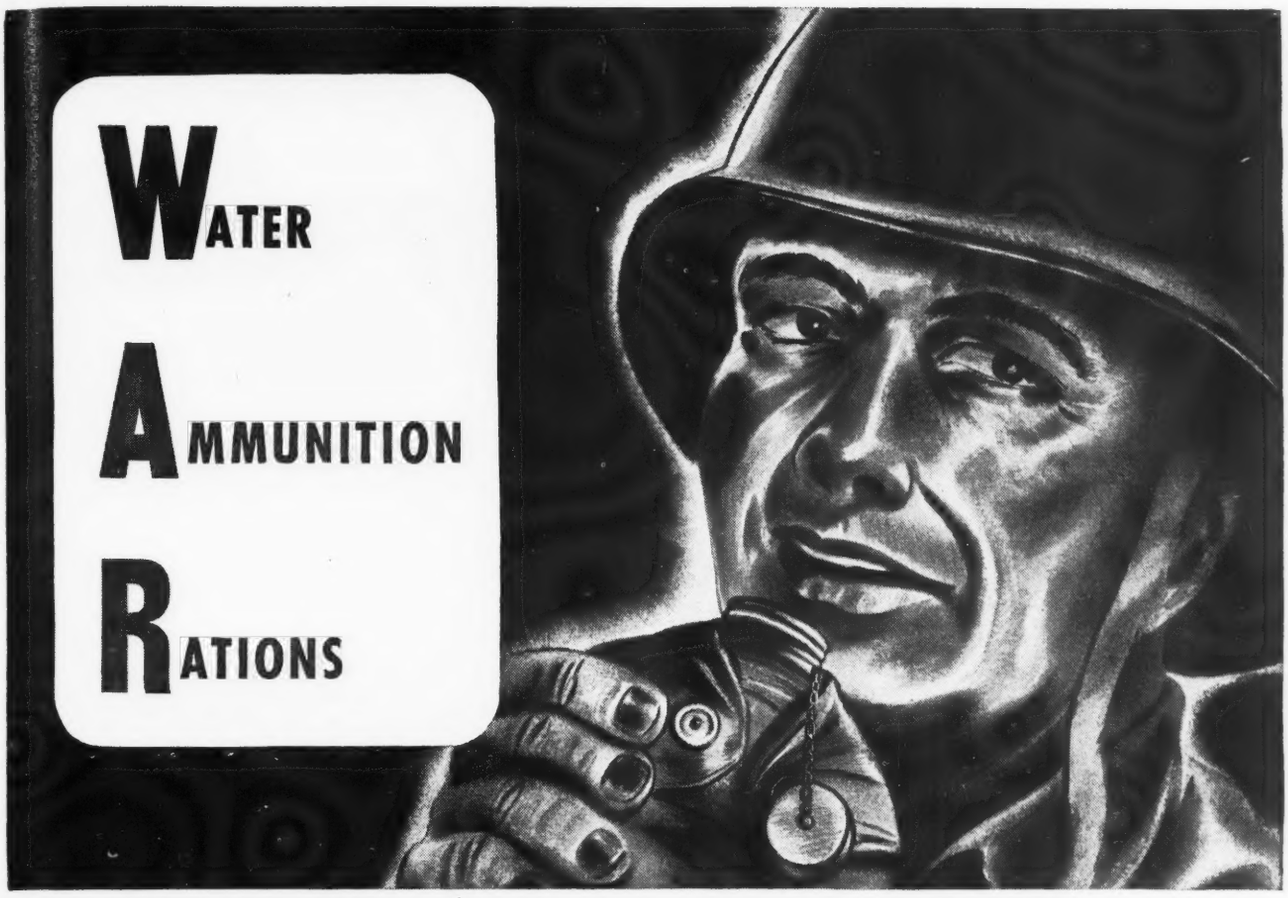

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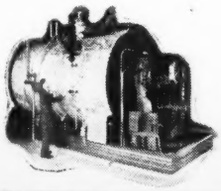

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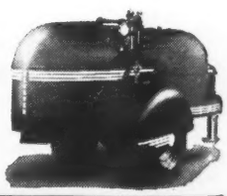

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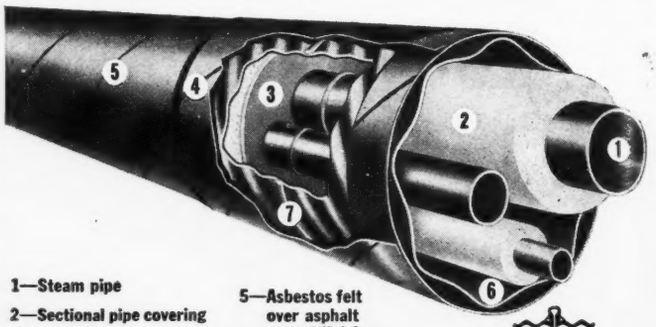
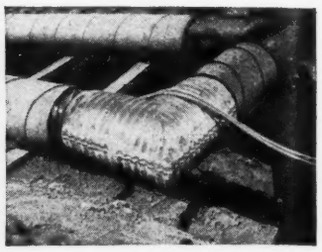


1—Steam pipe
2—Sectional pipe covering
3—Pipe support
4—Thick strip asphalt applied after welding
5—Asbestos felt over asphalt coated Hel-Cor
6—Air space
7—Butt welded connection

FLANGE WELD
BUTT WELD
LAP WELD

Butt-welding Hel-Cor conduit connection between units.



Welded split elbow conduit fitting.

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★WeldELLS alone have all these features

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- ▶ **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- ▶ **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- ▶ **Selective reinforcement**—provides uniform strength.
- ▶ **Wall thickness never less than specification minimum**—assures full strength and long life.
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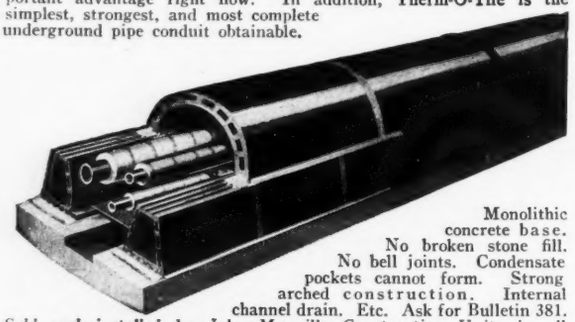

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Write your name, firm, and address on the margin of this page, tear out with the checked squares above, mail, and you will hear from us promptly.

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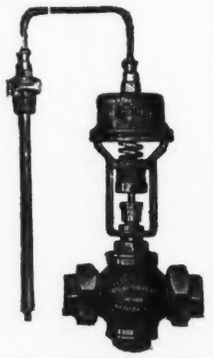

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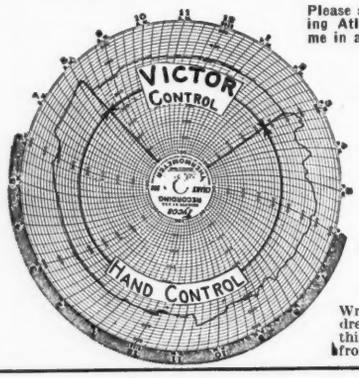

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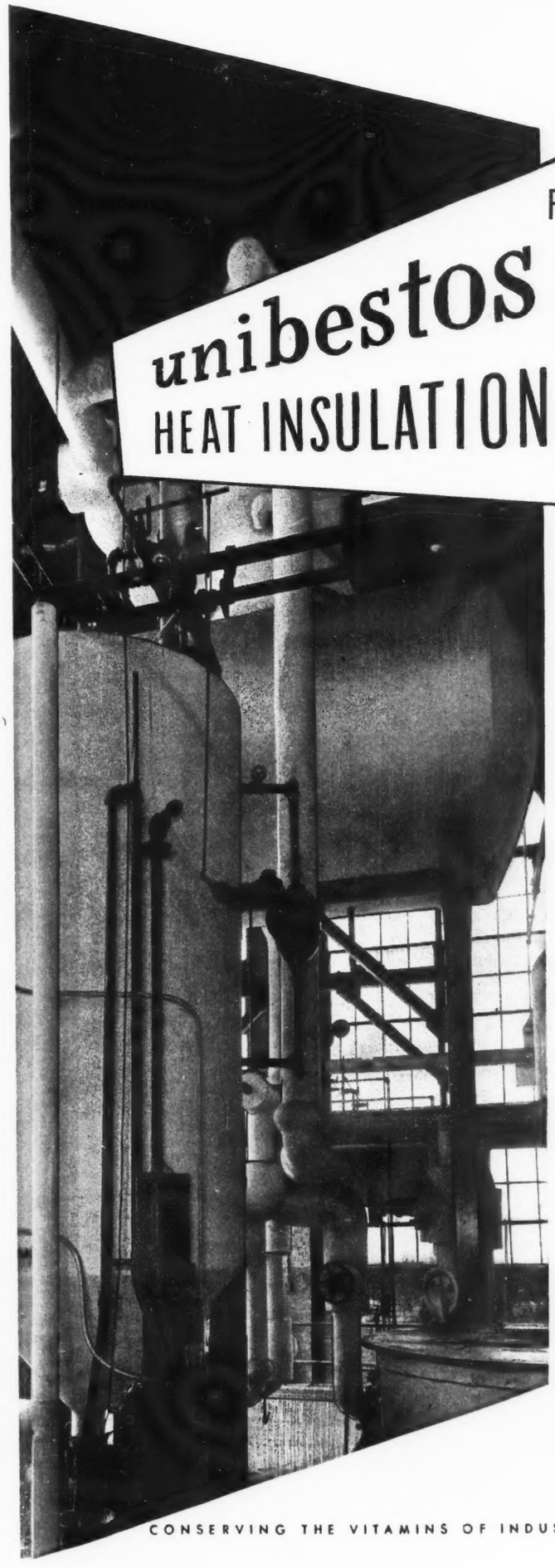

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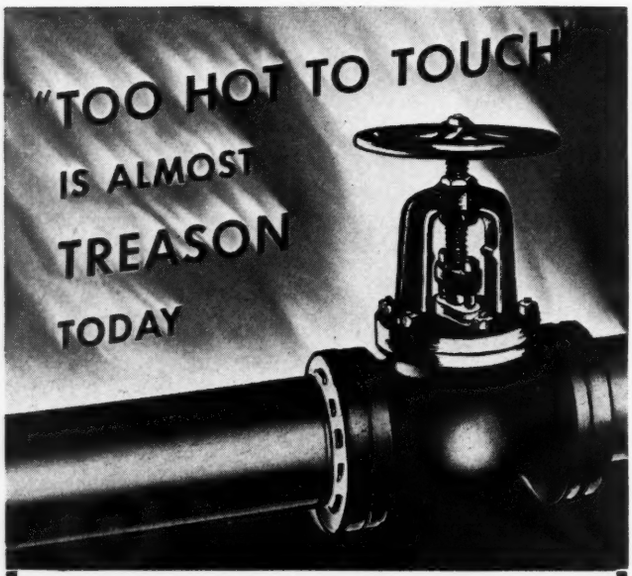

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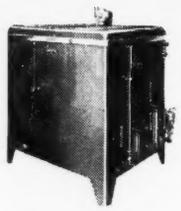

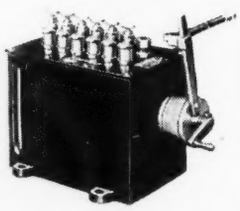

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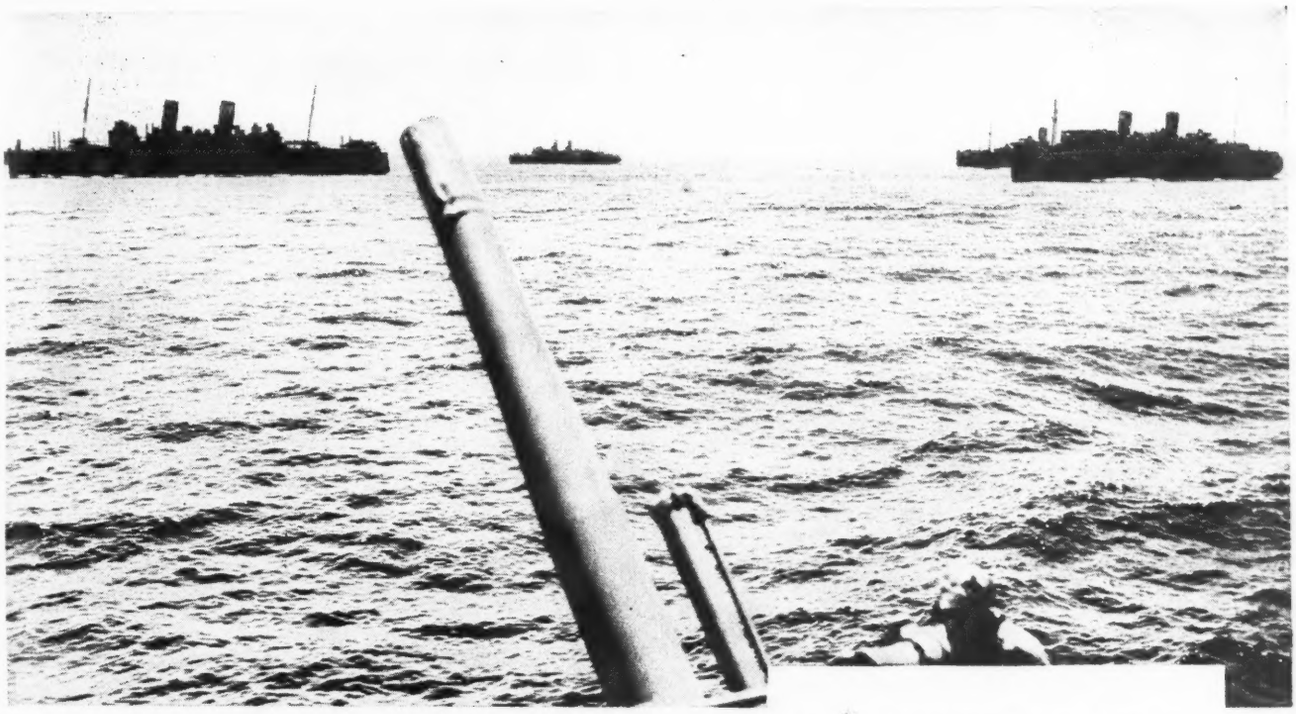

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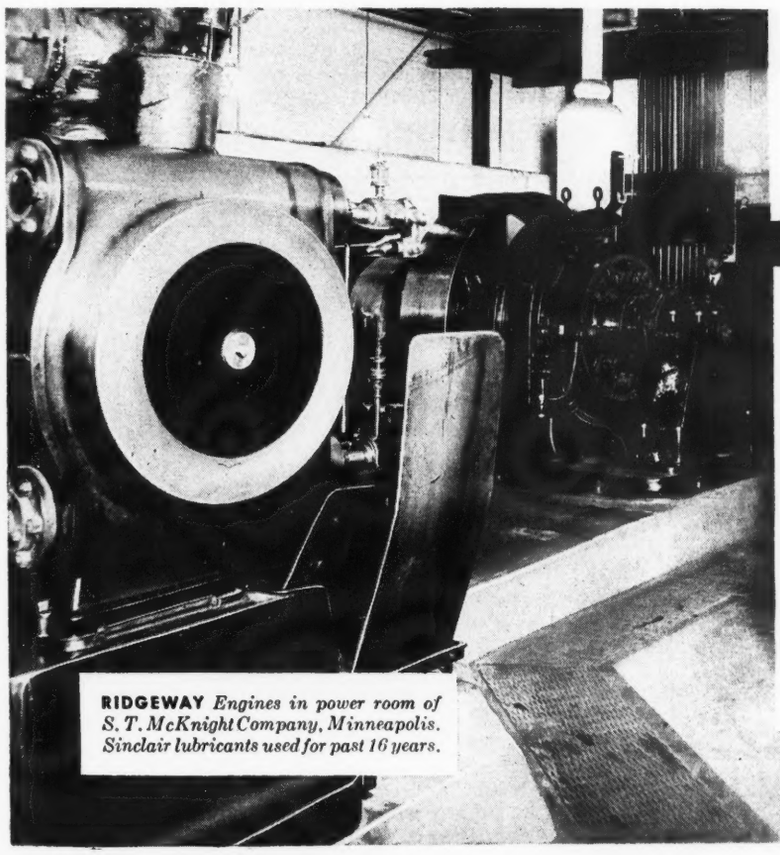

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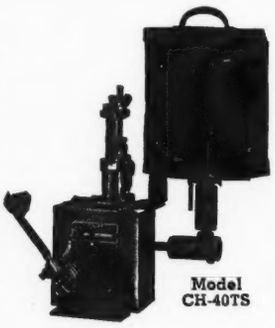
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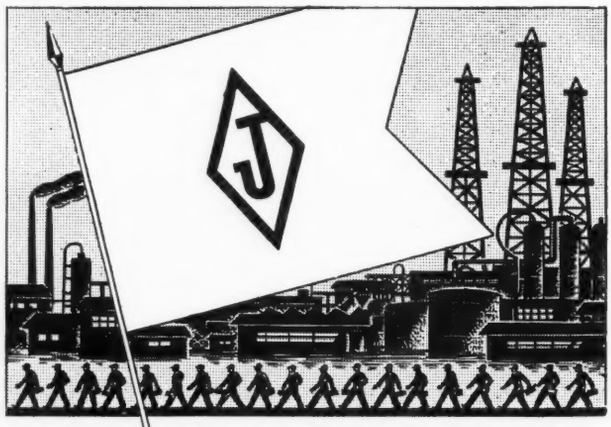

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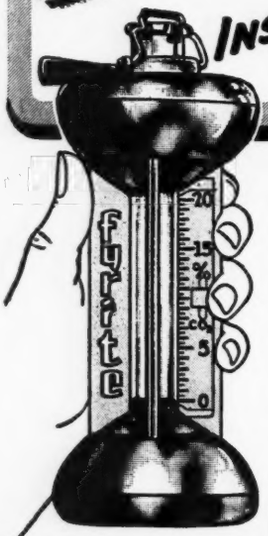

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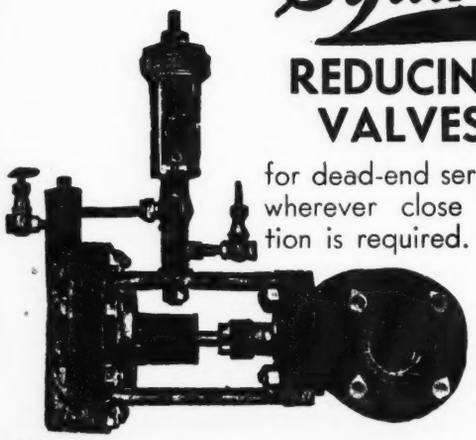

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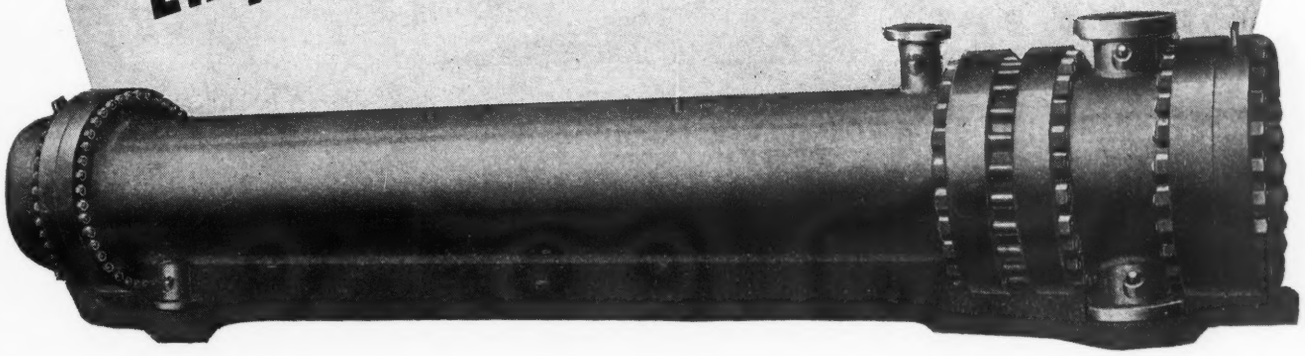

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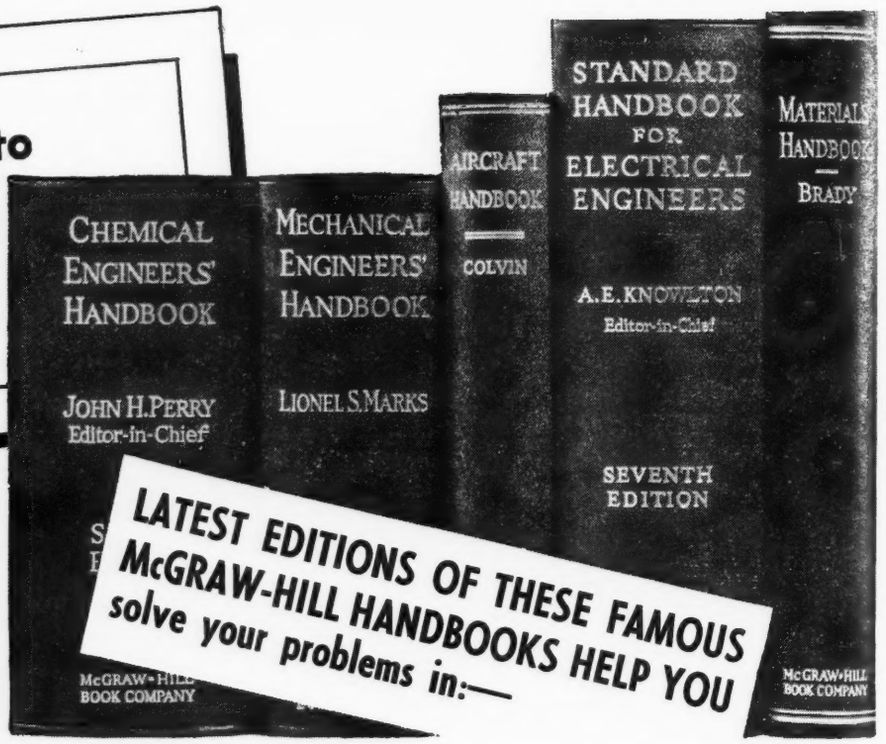

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"Victory" Ships Being Tubed with Aluminum Brass

Aluminum Brass has been selected by the Maritime Commission for condenser tube installations on the "Victory" ships, trawlers, and tankers now under construction in the war program. Major factor in the choice of Aluminum Brass is its excellent resistance to air impingement corrosion.

This form of attack has become much more common with the growing use of turbine-driven ships, and with the tendency toward higher vacuums, with the consequent need of increasing the volume of circulating water. These trends have introduced problems of greater velocity, turbulence, and aeration—exactly the conditions that give rise to impingement attack.

Aluminum Brass was first introduced in this country about fifteen years ago, and won immediate acceptance from marine and seaboard power plant engineers who found that Admiralty did not give adequate resistance to impingement attack. Laboratory tests at Bridgeport, conducted on samples of various alloys immersed in circulating harbor water and subjected at the same time to a stream of air, showed the superiority of Aluminum Brass to Admiralty. Research work was then undertaken to improve the resistance of Aluminum Brass to dezincification, and the result was the development of Cuzinal, Bridgeport's Aluminum Brass.

The presence of about 2% aluminum in this alloy adds greatly to the difficulty in obtaining sound castings and in subsequent processing. It is cast in electric furnaces in solid billet form and heated to redness and extruded as heavy-walled tubing. Special equipment is used for reducing the tubing to smaller sizes.

With its high resistance to impingement, and with methods available for satisfactory processing, Cuzinal is finding growing use in modern marine and power plant installations.

Tests Show Superior Resistance Of Duronze IV to Brackish Water

Bridgeport's Arsenical Aluminum Bronze Demonstrates Its Effectiveness as Condenser Tube Alloy for Severe Service

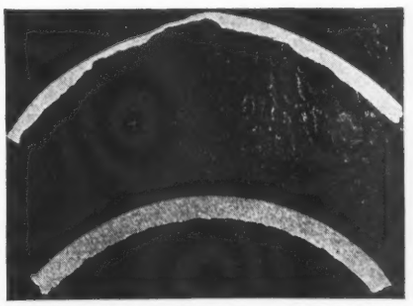
An extremely effective weapon in combating condenser tube corrosion in seaboard power stations has been discovered in Duronze IV, the Arsenical Aluminum Bronze developed by Bridgeport Brass Company. This fact has been demonstrated by recent service tests, in which Duronze IV showed striking superiority to Admiralty, Aluminum Brass, and Cupro Nickel.

Condenser installations on polluted estuaries and harbors have long been recognized as presenting one of the most complex corrosion problems encountered in power plant practice. The mixing of tidal salt water with polluted fresh water, which may contain acid wastes, sewage, and cinders, introduces conditions that result in extremely severe corrosive attack on most of the commonly used tube alloys. Hence the demonstrated superiority of Duronze IV under these service conditions is expected to be of great value in the lengthening of condenser tube life.

Results of Comparative Tests

The service tests on Duronze IV, Admiralty, Aluminum Brass, and Cupro Nickel were conducted in an installation using circulating water of the type described above. After nine months, both the Admiralty and the Aluminum Brass were so severely pitted that they were considered unsatisfactory for further service, and accordingly were removed.

The remaining samples of Duronze IV and Cupro Nickel were removed for examination after a total of 17 months' service. The Cupro Nickel (which is generally considered to be the best alloy for marine service) had thinned down to a marked degree, and in some places was pitted through. The Duronze IV showed very little effect as a result of this severe test. Comparative condition of the Cupro Nickel and Duronze IV is illustrated in the accompanying unretouched photograph.



Unretouched photo shows comparative condition of Cupro Nickel and Duronze IV after 17 months' service under severe harbor water conditions. Note the thinning of the Cupro Nickel (*top*), and the slight effect on the Duronze IV (*bottom*).

Power plant and marine engineers may find it helpful to test Duronze IV under actual operating conditions, to compare its performance with other tube alloys.

Announcing a New Information Service

This is the first issue of a Marine and Power Edition of the Copper Alloy Bulletin. Like its long-established and highly regarded counterpart in the metal-working field, it will provide helpful information for the users of copper and copper alloys. The Marine and Power Edition will deal specifically with the problems of the marine and power plant industries.

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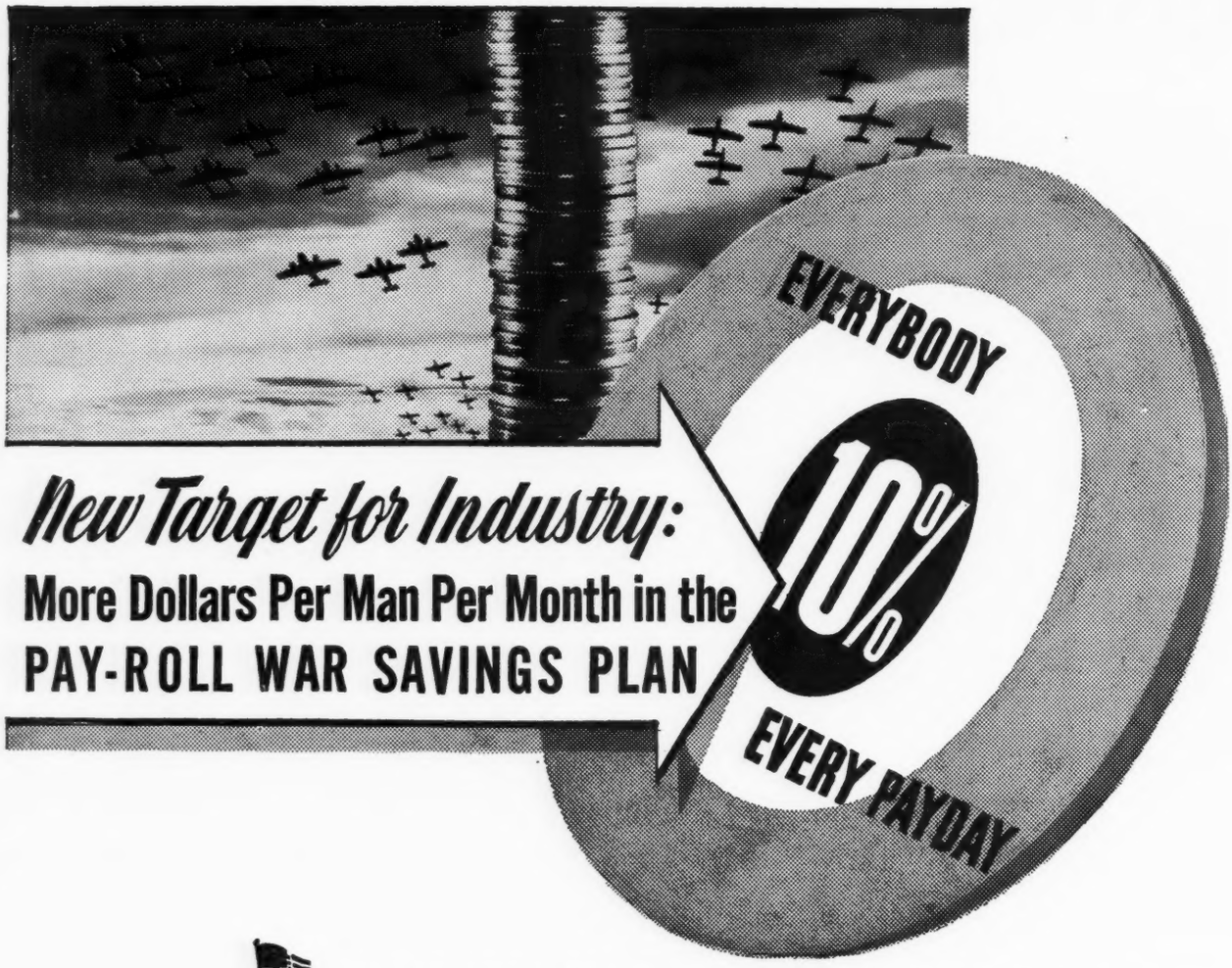

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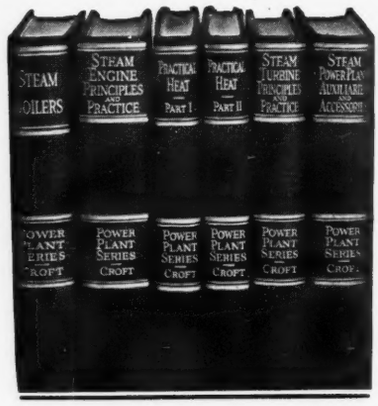
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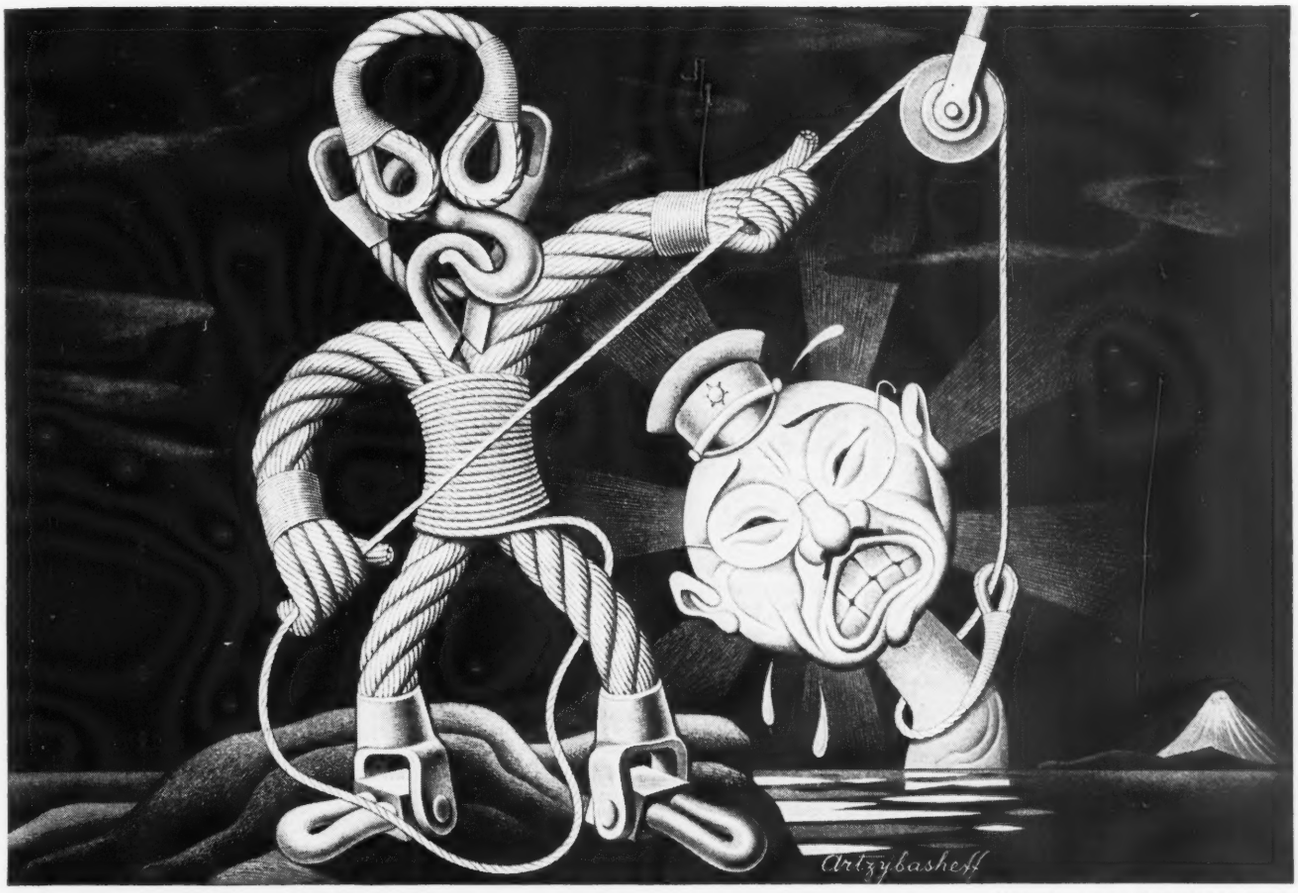

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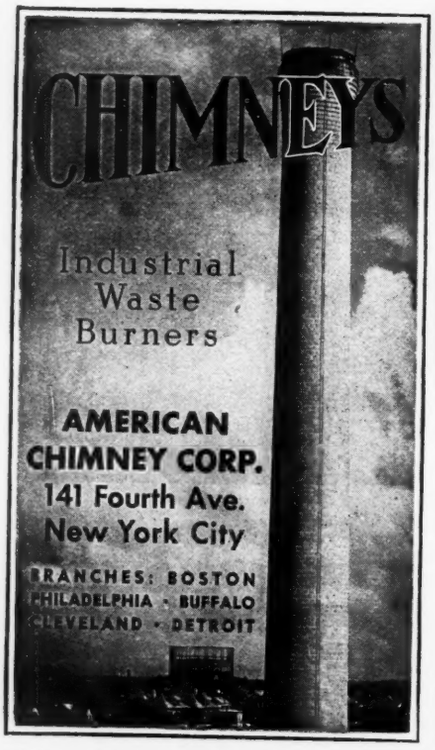

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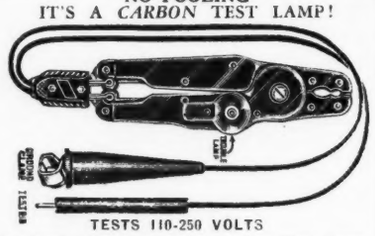

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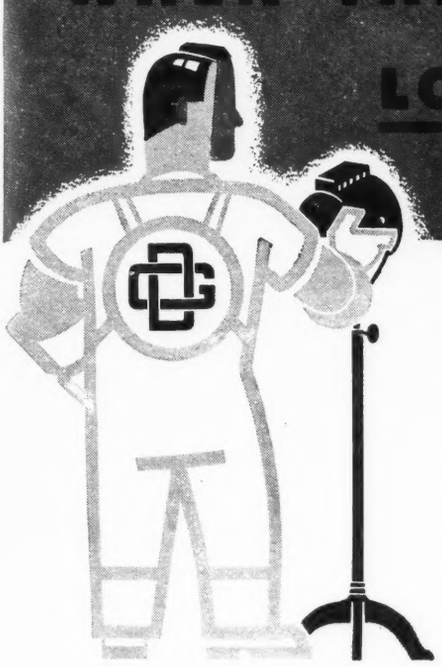

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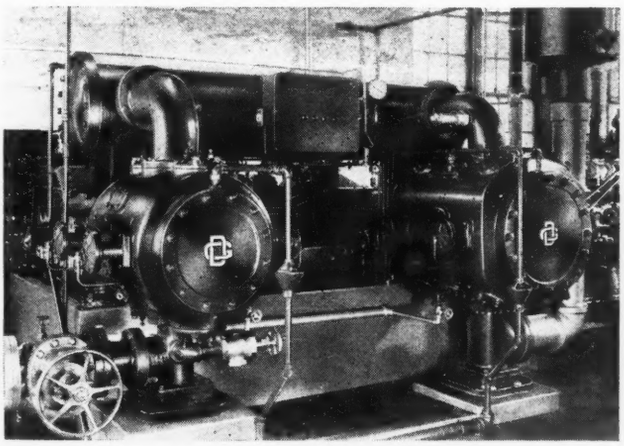

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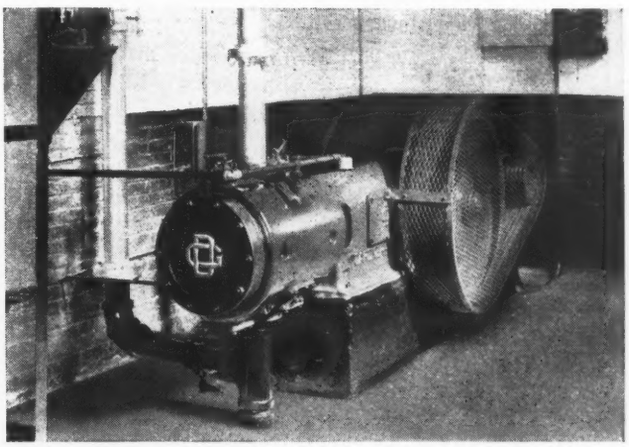
"Operating between 16 and 24 hours daily, two 'HA' Compressors here were installed over a year ago. No production time has been lost, nor has there been any maintenance cost."

Gardner-Denver Class "RX" Single-Stage Horizontal Air Compressor



• A ruggedly built compressor with remarkably low horsepower requirements. Capacities from 89 to 1292 cubic feet displacement per minute.

"During 6900 hours of steady operation, our Gardner-Denver 'RX' Compressor has required no replacements and very little maintenance. No lost time has been charged to this machine."

"In a recent six-month period, our 'RX' Compressor has been operating day and night. With a total of 3,740 hours to its credit, it has caused no lost production time whatsoever. The compressor operates an average of 75% load for 16 hours a day and 50% load for the remaining 8 hours."

GARDNER-DENVER PRODUCTS HELP SPEED VICTORY

For complete information on Gardner-Denver "HA" and "RX" Horizontal Air Compressors, write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER

Since 1859

"Praise the Lord and *Pass the Ammunition*"

THIS Pearl Harborism,* uttered by a fervent Navy chaplain, will live in our school books long after today's headlines and swaying battle lines have passed into history.

It exactly expresses the unique combination of the spiritual and the practical which is inherent in our national character.

. . And America IS *passing the ammunition.* Starting with an atrophied military explosives industry in 1939, the Production for Defense program had raised the rate of "passing the ammunition" by 1400% at the time the chaplain spoke.

▶ Since then, according to an official statement of Donald Nelson:

"Explosives and ammunition are being made at many times the rate of last year as newly constructed plants come into operation. TNT is being made at a rate five times that before Pearl Harbor. Smokeless powder is being produced at a rate almost twice that before Pearl Harbor. One new plant is making more TNT today than the entire explosives industry produced in peacetime and there are several of this type of plant."

Incendiary bombs are vital ammunition in the kind of war we are in. America's chemical industry is far ahead of schedule in passing along that potent ammunition.

Magnesium is part ammunition, part construction material. You know it's now being taken from sea-water, but do you know that we are making at least 100 times as much magnesium now as we did in 1938?

100-octane gasoline isn't ammunition, but it's handy to have around in a war, because bombers using this product of American chemistry can carry an extra ton of what it takes to win.

Synthetic rubber is another necessity in passing the ammunition. The Chemical Industry faces the staggering job of producing more rubber than all the rubber trees in the world were able to pour into the American market prior to the war . . . 875,000 tons per year by 1944 is the goal. Those of us who have seen tank-factories and shipyards grow faster than the corn-crops they replaced believe the Chemical Engineers of America will do the job.

What is the secret of these amazing modern counterparts of the frontiersman's ability to turn from peace to war?

▶ One of the important answers is Chemical Engineering. We just naturally have more men and more machines that know how to make a molecule behave than any two nations on earth.

Starting after World War I, our chemical engineers used the experience gained in guncotton factories to develop the vast peacetime Chemical Industry which gave you rayon, lacquer, transparent wrapping paper, plastic telephones, knockless gasoline, shatterproof glass, synthetic vitamins, laboratory-fathered medicines, plastic tips for your shoe laces, nylon hosiery, and thousands of other comforts to help you live a peacetime Life of Riley.

This vast activity of making life more livable for peaceful Americans had created an enormous pool of management and production men in our chemical industries.

When war came, these men answered their country's call, by rearranging their peaceful atoms into bellicose molecules that would explode, fly, float, shoot or stop a bullet.

Today, fertilizer, salt, whiskey, rayon, even pine stumps are being turned into products of unrecognizable ferocity.

▶ When the war is over, it will be the imagination of the Men of Chemistry that will set our great new war-chemical plants upon a new era of peacetime fruitfulness. Even while the chemical engineer is breaking production records for war, he is planning for a peacetime production that will revert these molecules toward serving our daily lives. Chemical Warfare will become Chemical Welfare, through Imagination.

★ ★ ★

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W.P.B. . . . this 7th in a series of newspaper advertisements is published by the McGraw-Hill Network of Industrial Communication.

*Also title of Gene Lockhart's famous fighting song of World War II

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET . . NEW YORK

This advertisement appears in a group of newspapers on Wednesday, September 9, 1942

. . . . . and pass the INFORMATION

WHEN an American gunner calls for ammunition, whether he wears a cross—like the chaplain in our newspaper advertisement—or a tattooed mermaid, he sets in motion the mightiest war-machine on earth . . . American Industry.

Knitting together all the industries of America, making it possible for them to turn *quickly* from peace to war, is the Industrial Press.

When the gunner yells for AMMUNITION, industry yells for INFORMATION. It is the job of the industrial magazines to supply it.

"What do we do when we can't get stainless steel for a Toluol recovery plant?"

"Which is the best section of the country for locating our new plant, considering power supply, bombing range and transportation?"

"How can we step-up the alcohol output of our stills, without using scarce metals?"

"What's the best method of training 18,000 green hands to get quick operating efficiency?"

These are typical of the questions that flow over the desks of our editors day after day.

They keep nearly 900 McGraw-Hill editors and engineer-correspondents busy, making field calls, finding the best answer to each problem and reporting the results to management and production men.

Industrial advertisers supplement this work by showing how their products meet specific needs.

This constant interchange of information is part of the strength and adaptability of American Industry.

It is so important that executives are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, write to The Reading Counselor, McGraw-Hill Publishing Company, Inc.

★ ★ ★

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,000,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Factory Management & Maintenance
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

SEARCHLIGHT SECTION

POSITION VACANT

(See also "Selling Opportunity" Offered)

DIESEL PLANT ENGINEER, for operation and maintenance utility power plant located Guayaquil, Ecuador. Man with extensive diesel maintenance and installation experience preferred. Will also consider technical graduates with maintenance and operating experience. Prefer men experienced in diesel utility plant operation. Spanish desirable, not essential to start. Apply by letter giving full past experience and salary earned in each position; also Selective Service classification and status. Salary $300-$350 per month. P-309, Power, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

(See also "Selling Opportunity" Wanted)

MECHANICAL ENGINEER, Age 36. Graduate. Offers 13 years of extremely broad experience all phases steel mill and power plant engineering. Desires position of plant or power engineer. Minimum salary $6000. Now employed. Address PW-299, Power, 520 N. Michigan Ave., Chicago, Ill.

CHIEF OPERATING ENGINEER — Thirty years experience covering a very wide range of training in the operation and maintenance of utility central stations, substations and industrial power plants. Thoroughly familiar with H.P. Pulverizer and stoker fired boilers. Technical school graduate. Many years in responsible supervisory positions. References furnished. PW-301, Power, 330 W. 42nd St., New York, N. Y.

CHIEF ENGINEER — centrifugal pumps. 22 years experience. All engineering phases, many years in responsible supervisory positions. Now hold executive engineering position with a leading pump company. Eastern location preferred. PW-310, Power, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

REPRESENTATIVES WANTED. For a full line of Separatory Equipment for Steam, Air, Gas, etc. Lines thoroughly established, desires some additional representatives. RW-311, Power, 520 N. Michigan Ave., Chicago, Ill.

OPPORTUNITY WANTED

ENGINEERING SALES ORGANIZATION, long established in Boston, Mass., with excellent shipbuilding, industrial, public utility and consulting engineering connections, now prepared to represent a manufacturer of important mechanical or electrical equipment. RA-312, Power, 330 W. 42nd St., New York, N. Y.

PRICE & COMPANY

CONSULTING ELECTRICAL AND MECHANICAL ENGINEERS

Technical Advisers to the Purchasers of Used Steam and Electrical Equipment

Inspection *Redesign* *Reports*
Installation Supervision

88 Broad Street, Boston, Massachusetts

ADELBERT B. PRICE
Registered Professional Engineer

DIESEL ENGINES

BOUGHT—SOLD

One of the Largest Used Stocks in the East. Send us your offerings and inquiries.

ALJON ELECTRIC DIESEL CO.
151-5 Washington St. B'klyn, N. Y.
Main 4-3804-5

WANTED

A PLANT ENGINEER

by well-known

FOOD MANUFACTURER

Old established concern specializing in packaged dehydrated baking mixes requires the services of a plant engineer qualified to overhaul and speed up production.

A real future is in store for the right man. He may be employed somewhere at present as an assistant but looking for a chance to prove his worth as production chief. Or he may be presently unemployed because of war conditions. Or he may be a top flight plant engineer already holding down a good job but looking for new worlds to conquer.

We have a lot of problems due to substantial increase in business and will move promptly and generously if the right man answers this advertisement. Let's hear from YOU. State experience, present salary and salary desired. Address in full confidence.

R. D. L.

38 East 37th Street, New York

OPERATING ENGINEERS—WANTED

Operating engineers who have or have had a Marine Engineers' License. Wages from $300 to $700 per month.

Apply

Local No. 33, M. E. B. A.
227 Fulton Street New York City

1—500 H.P. **RIDGWAY STEAM ENGINE GENERATOR** No. 3254, Bore—24 in. x 26 in. stroke 4 Valve, nonreleasing, Corliss type. Direct connected to 300 K.W. Gen. 125 & 250 Volts; 3 wire. Dobrowolssy balance coil. Switchboard included.

1—36 in. **Ludlow gate valve**, non-rising stem; 12 in. bottom outlet.

THE G. P. S. CO.
1981 East 105th St. Cleveland, Ohio

IMMEDIATE DELIVERY

2—18 & 11 x 14 **Sullivan Angle Compound Compressors** with electric motors.

1—10 x 6½ x 8 **Ingersoll-Rand** Type XRB **Compressor.**

1—50 K.W. 250 Volt **D.C. Generator** direct connected to Erie-Ball steam engine.

BERT TOLBERT MACHINERY COMPANY

Ft. Worth, Texas

DIESEL ENG. GEN. SET FOR SALE

6 cyl. 14 x 17 F.M. 257 R.P.M. VA, Solid injection d/c to 300 KVA, 3/60/2300 gen. with d/c exciter complete with auxiliaries—excellent condition—can be seen in operation. Price $12,000.

ILLINGWORTH ENGINEERING CO.
312 Hildebrandt Building
JACKSONVILLE, FLA.

FOR SALE

1—**Erie City** Unitype Serial 295 LE Size C 1200 R.P.M. **Pulverizer** (Capacity about 4500# of coal per hour)

1—**General Electric** D.C. **Generator** No. 1341203 Type R.C. 34, Form A, 525 R.P.M. 125 V. 140 Amp.

8—**Crosby** 4" ASME Standard **Safety Valves** mounted in pairs on Y Fittings 4 x 4 x 6 125# Operating Pressure.

2—**Foster** 6" Offset non-return Boiler **Stop Valves.**

2—**Foster** 6" Angle non-return Boiler **Stop Valves.**

LITTLE FALLS LAUNDRY COMPANY
Little Falls, N. J.

IMMEDIATE DELIVERY

3—G.E. Type H, 200 KVA, 1 ph., 60 cy., 22000 pri. 2300/4000Y sec., transformers with taps and oil.

3—G.E. Type H, 37.5 KVA, 1 ph., 60 cycle, 23000 pri, 115/230 volt sec.

Several hundred 550 volt, 3 ph., 60 cycle AC motors.

We have large stock all kinds equipment. Send us your inquiries.

JACKSON-BAYLEY ELECTRIC CO.
CANTON, OHIO

FOR SALE

1—35 KW, DC, **MG Set**, 125 volt, direct connected to 50 H.P. AC motor with switchboard.

1—150 KW, DC, **Westinghouse, Generator**, type S, 250 volt, 550 RPM, 600 amp.

DIESEL INSTALLATION CORPORATION
of America
426-428 Broadway Brooklyn, N. Y.

PUMP

18 x 6 Union Belt Drive Disc Valve Dry Vacuum Pump—483 CFM.

J. H. ROSEBERRY
605 Crosby Bldg. Buffalo, New York
Telephone, Washington 1432

FOR SALE

3 TERRY TURBINES

1—15 HP driving Economy Pump 400 GPM, 90 ft. head

2—40 HP driving Penna Pumps 1200 GPM, 100 ft. head

A. J. BLECKI
408 Donovan Bldg. Detroit, Mich.

FOR SALE

1—300 KW **Allis-Chalmers** 3/60/2300 volt **Turbo Generator**, complete condenser, direct connected exciter and switch board. Located in Arkansas.

Approximately 300 ft. of 16" **B&S Cast Iron Pipe.** Located in Louisiana.

RALPH H. ROGERS & CO.
306 Millsaps Bldg., Jackson, Mississippi

ENGINES

Two 700 H.P. Winton marine engines, 1300 R.P.M. 12-Cylinder—Perfect condition.

WALES MERCANTILE CORP.
17 John Street New York City

FOR SALE

CENTRIFUGAL PUMPS

from 2750 GPM to 9700

EASTMAN KODAK COMPANY
Kodak Park Works Rochester, N. Y.

FOR SALE

STOKER

Illinois Forced Draft Chain Grate Stoker, with all accessories, suitable for burning bituminous coal. 150 sq. ft. grate surface, drive 10 HP coupled to Reeves Drive. No. 8 American forced draft fan for 5¼ x 6 American Blower, engine included.

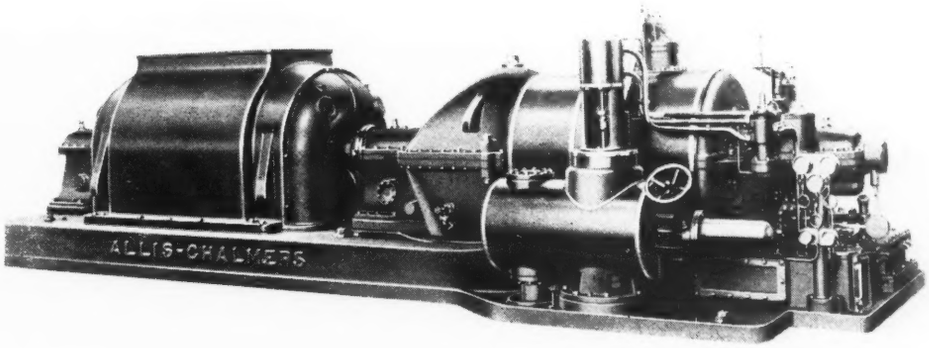
FS-314, Power
330 W. 42nd St., New York City

Equipment Wanted—page 311

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500° F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1250 KVA, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

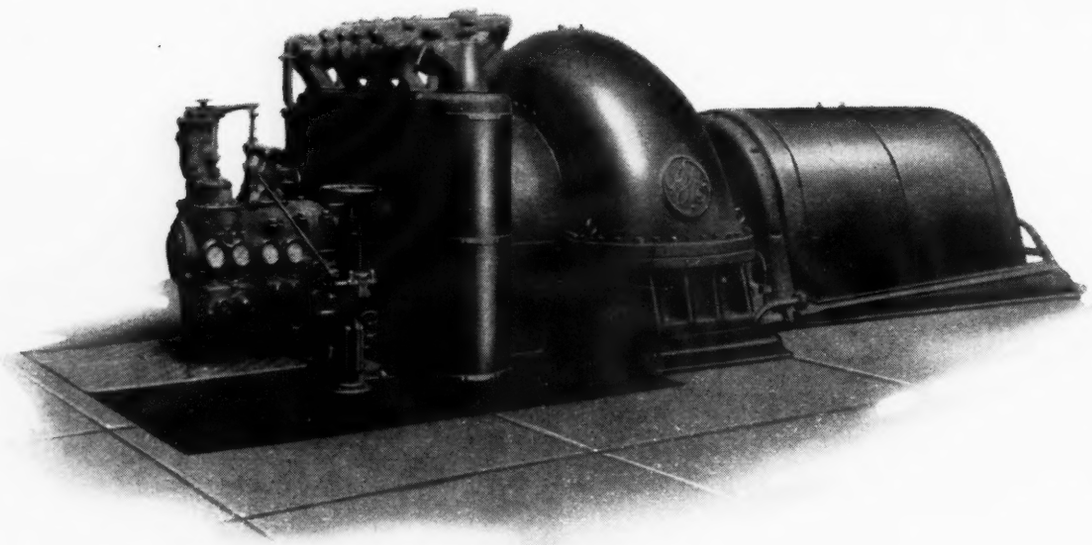
1—G.E., 625-KVA, 3/60/2300-v, 200# 500° TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Penobscot Building DETROIT, MICH.

We Deal in Turbo-Generators Exclusively

ELECTRICAL POWE



Actual Photograph

3125 KVA GENERAL ELECTRIC CONDENSING TURBO UNIT

3125 KVA General Electric Alternating current generator, 3 phase 60 cycle 2400/4160 volts 3600 RPM direct connected to General Electric condensing turbine 225-400 lbs. steam pressure 700 deg. TT. Equipped with surface condenser and auxiliaries.

ALTERNATING CURRENT TURBO GENERATORS

3 Phase 60 Cycle

6250 KVA GENERAL ELECTRIC condensing 200-225 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

3125 KVA GENERAL ELECTRIC condensing 225-400 lbs. pressure, 700 deg. TT, 3600 RPM with surface condenser; 2300/4160 volts.

1250 KVA ALLIS CHALMERS condensing, 150-200 lbs. pressure, 100 deg. superheat, 3600 RPM with jet condenser; 2300 volts.

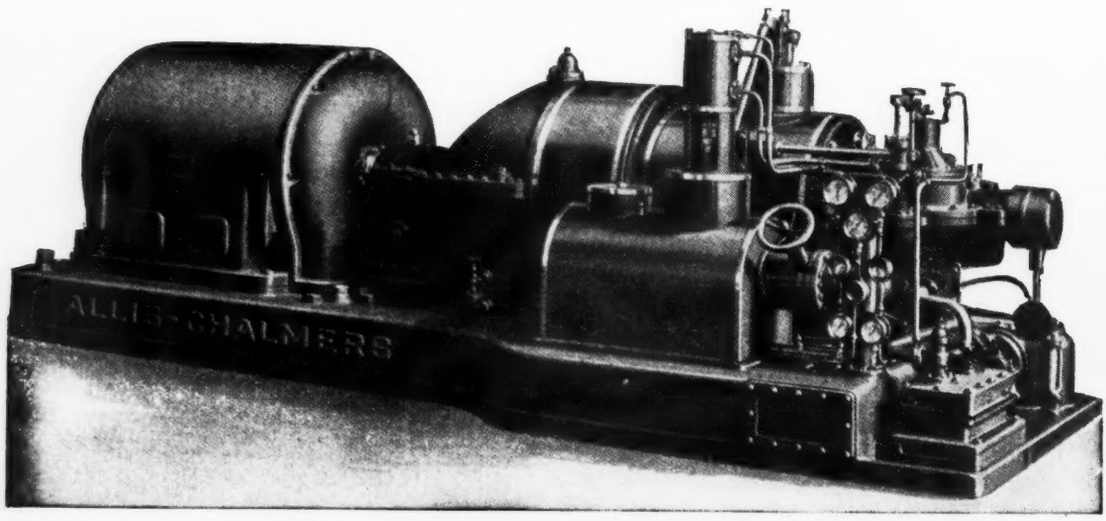
ALTERNATING CURRENT DIESEL GENERATORS

3 Phase 60 Cycle

625 KVA GENERAL ELECTRIC BUSCH SULZER full diesel, 300 RPM, 2300 volts.

510 KVA GENERAL ELECTRIC-WORTHINGTON full diesel, 200 RPM, 2300 volts.

300 KVA FAIRBANKS MORSE full diesel, 257 RPM, 2300 volts.



Actual Photograph

1250 KVA ALLIS CHALMERS CONDENSING TURBO UNIT

1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

125 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0.8 lbs. back pressure, 360 RPM.

ALTERNATING CURRENT ENGINE TYPE GENERATORS

3 Phase 60 Cycle

1250 KVA ALLIS CHALMERS, 2400/600 volts, 257 RPM.

210 KVA GENERAL ELECTRIC, 2300/600/480/240 volts, 225 RPM.

THE NATIONAL POWER

WER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers.

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers.

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers.

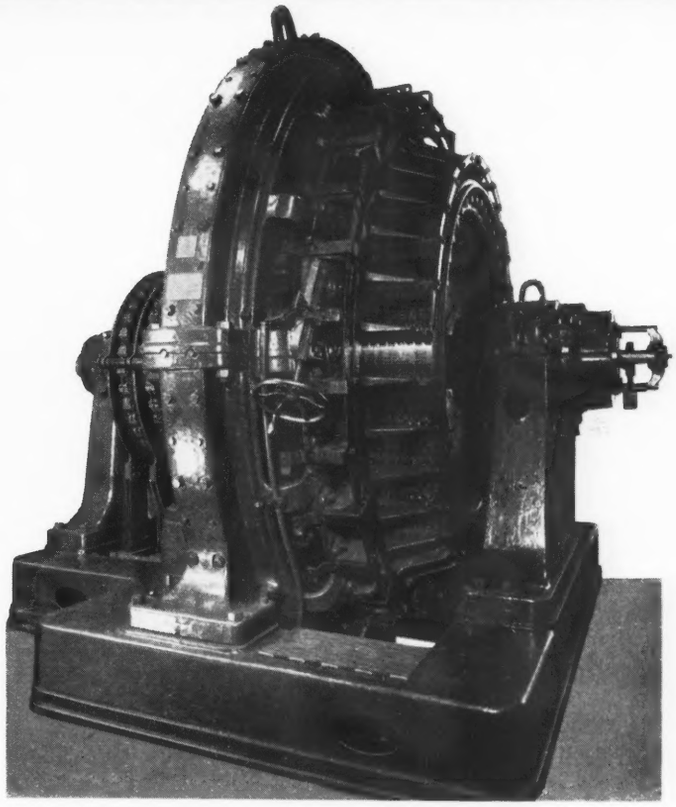
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers.

500 KW (2) WESTINGHOUSE, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 6600-445/222 volt transformers.

ROTARY CONVERTERS

25 Cycle

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer.



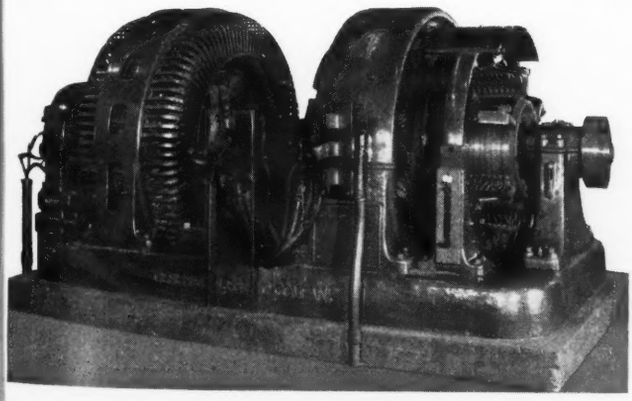
Actual Photograph

3500 KW WESTINGHOUSE ROTARY CONVERTER

3500 KW (2) Westinghouse booster type interpole rotary converters, 225-285 volts D.C. 225 RPM; 6 phase 60 cycle A.C. with 3 phase 60 cycle 13,200 volt transformers. Complete with control.

MOTOR GENERATOR SETS

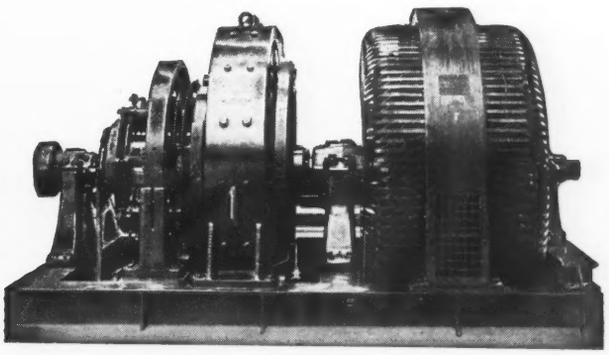
3 Phase 60 Cycle



Actual Photograph

750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

1500 KW MOTOR GENERATOR SET

AVAILABLE IMMEDIATE DELIVERY

1—ALLIS CHALMERS Motor Generator Set consisting of:
1500 KW, 600 Volt Direct Current Generator Direct Connected to a 2190 HP, 3 Phase, 60 Cycle, 4000/6600 Volts, 300 RPM Synchronous Motor.

TURBINE-GENERATOR UNITS

3 phase 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1563 KVA G.E. condensing 175-200 lb. pressure 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA Allis condensing 200 lb. pressure, 100° superheat, 2300/550/480 volts, 3600 RPM complete with direct connected exciter, and either with a surface or jet condenser. Modern.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

781 KVA Elliott automatic extraction condensing 200 lb. pressure, 100° superheat, 5 lb. bleeder, 2300 volts, 3600 RPM, complete exciter, switchboard, surface condenser and auxiliaries. Modern.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

TURBINE-GENERATOR UNITS (Con't.)

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

250 KVA General Electric non-condensing, 150-200 lb. pressure, 10 lb. gauge back pressure, 240 volts, 3600 RPM, complete direct connected exciter and switchboard.

125 KVA General Electric non-condensing, 150 lb. pressure, 10 lb. gauge back pressure, 240 volts, 3600 RPM, complete direct connected exciter and switchboard.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24" x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31" x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner, Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

312 KVA Elliott 4000/2300/550 or 240 volts, 180 RPM direct connected to 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. gauge back pressure.

ENGINE-GENERATOR UNITS (Con't.)

210 KVA Westinghouse, 480 volt, 257 RPM alternating current generator direct connected to Winton vertical Diesel oil engine.

ENGINE-GENERATOR UNITS

Direct Current

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

150 KW G.E., 1200 amps., 125 volts, 225 RPM direct connected 19"x20" Ames Unaflow engine, 110 to 140 lb. pressure, complete with switchboard and instruments.

50 KW General Electric, 125 volts, 1200 RPM direct connected 75 HP Terry non-condensing turbine, 150 lb. pressure, 15 lb. back pressure, complete with switchboard.

MOTORS

3 phase, 60 cycles

875 HP, WESTGH. 440 V., 240 RPM synchronous.

700 HP Allis 440 volts, 360 RPM slip ring complete with control equipment.

625 HP G.E., type ATI, 2200 volts, 257 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

200 HP G.E. 2200 V., 580 RPM squirrel cage.

150 HP (2) G.E. 440 volts, 1800 RPM squirrel cage.

125 HP. (3) 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

50 HP, type 1, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

MOTORS (Con't.)

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

300 KVA General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, three bearing belted generator complete with switchboard.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

1 PRACTICALLY NEW WESTINGHOUSE FREQUENCY CHANGER SET CONSISTING OF: 655 HP, 3 phase, 25 cycle, 2200 volts, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt, alternating current generator complete and equipped with direct connected exciters, all panels with instruments.

Utilities Electrical Machinery Corporation

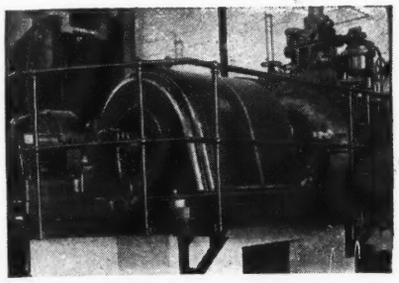
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

Bring on your "PRIORITIES"... bring on your INSPECTORS!

Hemphill

"HEMPHILL" EQUIPMENT IS READY— welcomes your closest examination . .



MOTOR GENERATOR SETS

2—200 KW, 250 volt, Electric Machinery, syn.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—20 KW, 600 volt, G.E. sq. cg.
1—15 KW, 250 volt, GE, sq. cg.

D. C. GENERATORS

1—75 KW, 675 RPM, 125 volt, Westinghouse.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
1—75 KW, 675 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 1200 RPM, 440 volt, GE, syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 720 RPM, 2200 volt, G.E., Sl Rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E. Sync.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP, 1800 RPM, 440 volt, West. Sq. Cg.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
1—150 HP, 720 RPM, 440 volt, G.E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G. E., slip ring.
1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM., 440 volt G.E. sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.

MOTORS—D. C. 230 VOLTS

1—250 HP, 760 RPM, Electro Dynamic.
1—100 HP, G.E. 575 RPM
1—100 P, 625 RPM, G.E.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—65 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
50 HP, 750 RPM, G. E. CO1829
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, GE.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt. Allis Chal.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.

TURBO-GENERATORS

2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 180 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TRANSFORMERS

2—400 KVA, G.E., 4156 240/180 v., Scott taps.
3—300 KVA, Pittsburgh, 7800-440 volts.
1—200 KVA, Pittsburgh, 7800 110 220 volts.
3—150 KVA, G.E., 33,000 2300/460 V.
3—150 KVA, Pittsburgh, 6600/440 volts.
4—150 KVA, G.E., 3 ph., 4150 120 208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts.
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
4—50 KVA, Westg., air cooled, 440-220-220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G. E., 2200-110/220 volts.
52—37½ KVA., 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Moloney, 2200-220/110 volts.
1—25 KVA, GE., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/-230 volts.
1—15 KVA G.E., 440/110-220 volts.
4—10 KVA G.E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole G.E. type FK-21
1—1600 amp. 7500 v., 4 pole Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

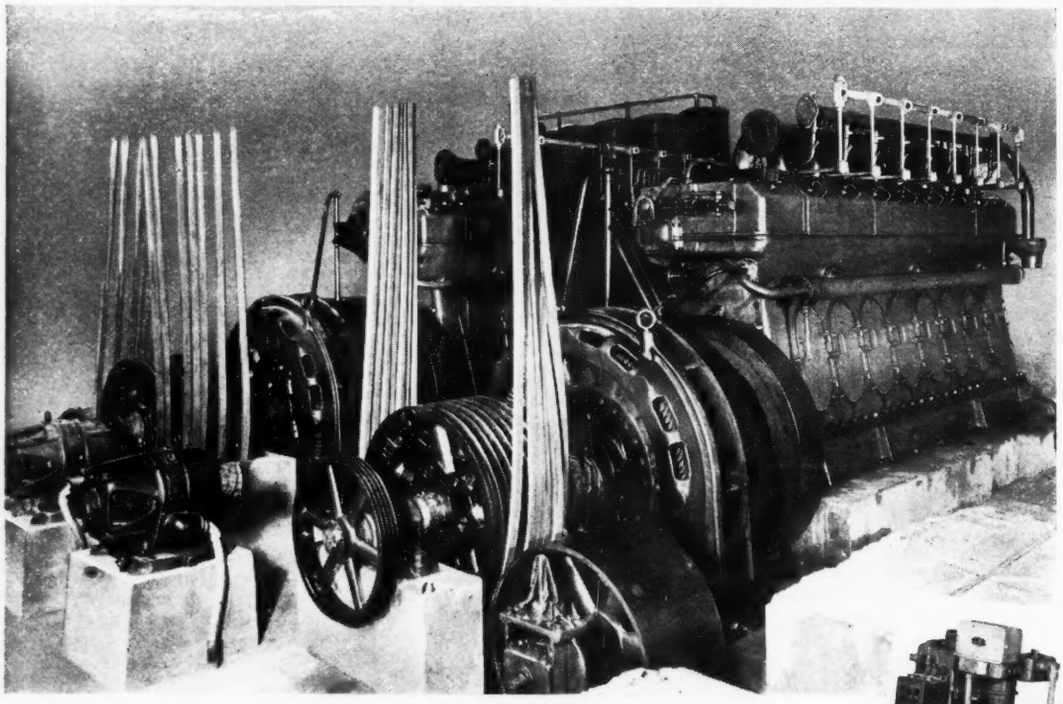
15,000 KVA Transformers for National Defense

IT'S "HEMPHILL" for POWER EQUIPMENT

J. L. HEMPHILL & CO. PHONES { NEW YORK: LOngacre 5-3227 / NEW JERSEY: UNion 3-2600

1602 53rd STREET, NORTH BERGEN, N.J.

Two Heavy Duty
DIESEL DRIVEN GENERATORS
BRAND NEW — NEVER USED!



3/60-440
Can Drive 350 KWS

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Built By RUSTON HORNSBY LTD. of LINCOLN ENGLAND

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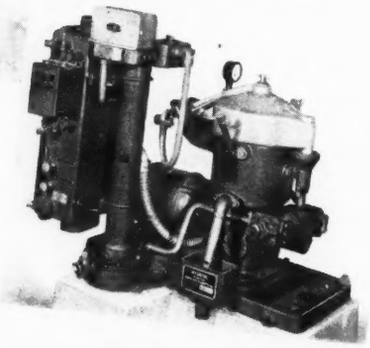


SPECIFICATIONS

Quantity

2—Ruston Vertical Diesel Engines, 440 H.P., 4 cycle, solid injection: 8 Cylinders 11x14½—428 R.P.M.

2—Model 15-D Gould Hydroil Fuel Oil Purifiers, direct connected to half horse power polyphase induction motor.

2—Alternators Ideal Electric & Mfg. Co., U. S. A. 150 K.W., 400 R.P.M., 3/60—440 V. 40 degree, 80% power factor engine type synchronous alternators with field discharge rheostats, field discharge resistance, damper windings and split rotor.

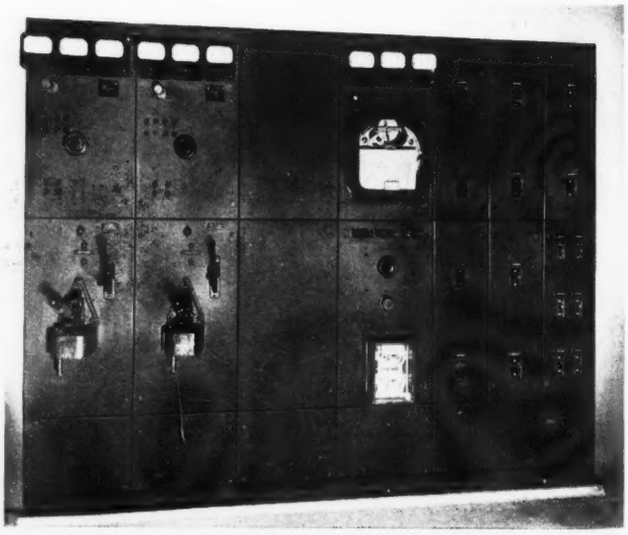
2—D.C. Belted Exciters mfgd. by Ideal Electric & Mfg. Co., U. S. A. 5 K.W., 1800 R.P.M. 125 volts, 40 degree shunt wound interpole types

1—Lexington Electric Switchboard, Seven Panels, 19 Nameplates, fused. Buss 800 amperes at current density of 800 amperes per sq. in. Instruments are Weston rectangular. Further information on request.

1—Struthers Wells Type F Oil Engine Exhaust Gas Cooler, containing 100—2" OD #10 BWG seamless steel tubes 12' length. Shell side working pressure 120# sq. in.

1—Struthers Wells Type NB-2 water to water exchanger, containing 16 1¼" steel tubes 10' length. Working pressure on shell side 50# sq. in. and 100# sq. in. on tube side.

Various belting, tanks, etc.



• PRICES ON APPLICATION •

ARNESSEN ELECTRIC COMPANY
116 BROAD STREET • NEW YORK, N. Y.

1892 — 1942

PAUL STEWART and COMPANY

HEAVY POWER-PLANT EQUIPMENT

CINCINNATI

2500 KW 200/250# 600° T.T.60/3/2300 Surface Cond. No Switchboard

2500 KW 60/3/2300 Near New—All Auxiliaries
(G.E. may recommend slight alteration—8 mo. delivery)

WH	300KW	60/3/240–480V	120–200#			Jet Cond.
WH	500KW	60/3/480V	125–200#	100°S.H.	3600 RPM	Jet Cond.
GE	500KW	60/3/2300V	125/175#	100°S.H.	3600 RPM	Surf. Cond
WH	500KW	60/3/2300V	160#		3600 RPM	Jet Cond.
WH	500KW	60/3/2300V	150#			
WH	500KW	60/3/2300V	150#	100°S.H.	3600 RPM	Jet Cond.
GE	750KW	60/3/600V	150#		3600 RPM	Jet Cond.
WH	750KW	60/3/550V	150#	125°S.H.	3600 RPM	
GE	750KW	60/3/2300V	200#	100°S.H.	3600 RPM	Jet Cond.
GE	750KW	60/3/2300V	175–200#	100°S.H.	3600 RPM	Surf Cond
AC	1000KW	60/3/440 V	175#	100°S.H.	1800 RPM	Surf. Cond.
GE	1250KW	60/3/2300V	200#	100°S.H.	3600 RPM	Jet Cond.
AC	1500KW	60/3 2300V	175#	100°S.H.	3600 RPM	Jet Cond.
AC	2000KW	60/3/440 V				Surf. Cond.
GE	2000KW	60/3/600 V	200#	100°S.H.	3600 RPM	Jet Cond.
GE	2000KW	60/3/2300V	150#	100°S.H.	1800 RPM	Surf. Cond.
GE	2000KW	60/3/2300V			1800 RPM	Jet Cond.
GE	8000KW	60/3/6600V				

25 CYC. TURBO ALTERNATORS

GE	7500KW	25/3/2300V	175–200°	Surf. Cond.	Switchboard	Sep. Exctr.
WH	3500KW	25/3/12000V	200#	Surf. Cond.	Switchboard	Sep. Exctr.

and matching sets for Central Station installation.

BOILERS

FOR 200#

5–520	HP EDGMR	Bx Hdr crs. drum	Stkrs	Compl	1922 Code
3–500	HP EDGMR	Bx Hdr long drum	Stkrs	Compl	1914
3–500	HP EDGMR	Bx Hdr			1914
15–500	HP EDGMR	Bx Hdr Chain Grates			
1–480	HP SPGFLD	Sect Hdr			1916
1–300	HP B&W	Sect Hdr Grates			1916

FOR 225#

1–650	HP B&W	Sect Hdr	Stkr	Compl	1916

FOR 250#

2–310	HP EDGMR	Bx Hdr	Stkrs	Compl	1926 Code
1–260	HP ERIE	Bent Tbs	Stkr	Compl	1917

FOR 160# to 180#

1–280	HP HEINE				1926 Code
3–250	HP WICKES	Bent Tbe	Stkrs	Compl	1916
1–492	HP STIRLING		Stkrs	Compl	1920
2–500	HP ERIE CITY		Stkrs		1916
4–600	HP STIRLING		Stkrs		1910
3–500	HP STIRLING				1915
5–500	HP EDGMR	Bx Hdr	Stkrs	Compl	1912

SPECIAL PURPOSE

Flash type unit 250#

1–700	HP Pwr Spec. Co.,	Sect. Hdr.	Stkrs	Compl	1916

STEAM PLANT COMPLETE
1560 KVA 2300 V

GE TURBINES

1–500	KW	Surf.	Cond.
1–750	KW	Surf.	Cond.

WICKES BOILERS

3–250	HP	175#	100°S.H.

Coal Handling
Busses—Piping
Building Materials
Everything

DIRECT CURRENT MACHINES—STEAM & ELECTRICAL

RECTIFIERS 60 cyc.

500KW	600V	Complete	Boveri	
900KW	600V	Complete	Boveri	

MGs 60 cyc.

1–200KW	250V	DC		C–W
2–400KW	600V	DC	Swtchbds	GE
1–1500KW	450V	DC	Sep Exctr	GE
1–1500KW	600V	DC		GE

ROTARIES—60 cyc.

2–400KW	250V	DC	Compl	GE

OTHERS 25 and 60 cyc.

TURBO GENERATORS

200KW	600V	Geared Kerr	100#
500KW	600V	Geared Kerr	100#
500KW	600V	Geared Kerr	150#

FOR FIFTY YEARS, HEAVY POWER SPECIALISTS

BOILER and POWER PLANT

Just Released for IMMEDIATE DELIVERY

BOILERS and STOKERS

3—316 H.P. Heinie Water Tube Boilers, 180 lbs. pressure, ASME code complete with Jones 3 retort underfeed stokers, complete forced draft equipment, boiler feed pumps.

Power Plant shut down just 90 days ago—all equipment in excellent operating condition—Write or wire for location and inspection details.

GENERATING EQUIPMENT

2—Ames Vertical Uniflow Engines, size 14" x 18", 4 cylinder, 150 lbs. pressure, 300 RPM, each direct connected to a Crocker Wheeler compound interpole Direct Current Generators, 240 volts, 2500 amperes, 300 RPM.

AC Generators Are Available For the Above Units If Desired

1—Ridgeway Turbo Generator Set, turbine mixed pressure, 135 lbs. high pressure and 16 lbs. low pressure, 0 superheat, 1800 RPM, direct connected to a Ridgeway 750 KW 230 volt Direct Current Generator, 3000 amperes complete with 3650 sq. ft. C. H. Wheeler surface condenser with circulating and air pumps.

PUMPS

1—2100 GPM 130 ft. Head 1800 RPM
1—2300 GPM 163 ft. Head 1800 RPM
1—1750 GPM 120 ft. Head 1800 RPM
2—2500 GPM 55 ft. Head 1800 RPM

TUBES

12,000 Condenser Tubes 1" OD 18 Gauge Admiralty 18 ft., long like new

STEAM ENGINES

100 KW SKINNER UNAFLOW 150#, 250 R.P.M. Direct Connected to 115 Volt WEST. Generator cpd. Interpole
80 H.P. CHANDLER & TAYLOR 13 x 16 —200 R.P.M. 100# pressure

WATER TANK

1—16,000 gal. Water Tower Tank, approx. 12' x 20' with 5" brass tail pipe, ladder, catwalk around tank, railing and 4 leg supports, complete.

MISCELLANEOUS

45 KW Diehl Cpd. Int. 550 RPM 230 V. D.C. Generator.
1—16 ton 50 ft. span overhead travelling crane, hand operated.

TRANSFORMERS — MOTORS — TURBINES — GENERATORS — STEAM ENGINES — BOILERS

HEAT AND POWER COMPANY, INC.

670 SIXTH AVE. Chelsea 2-5415 NEW YORK CITY, N. Y.

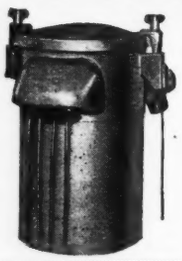
STEEL TANKS—PUMPS

22,000 gal. Tank on 44 ft. Tower.
35,000 gal. Tank on 90 ft. Tower.
50,000 gal. Tank on 100 ft. Tower.
80,000 gal. Tank on 68 ft. Tower.
1,000, 5,000 & 10,000 Bbl. Oil Tanks.
3—20,000 gal. Horizontal Oil Tanks.
6—11,000 gal., 12—5000 gal. Horizontal Tanks.
3—500-750 & 1000 GPM. Steam Underwriters Fire Pumps.

Tanks and Pumps bought and sold.

TIDEWATER
EQUIPMENT & MACHINERY CORP.
60 E. 42nd St. New York, N. Y.

-TRANSFORMERS-



TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
We will be pleased to quote prices on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

300 KW ROTARY CONVERTERS

1—300 KW Burke Rotary Converter, 250 volts D.C., rolled steel frame, 6 phase, 60 cycles with transformer and swbds.
1—300 KW Westinghouse Rotary Converter, 600 volts D.C. 6 ph. 60 cy., pedestal bearings, 1200 RPM.

TRANSFORMERS

1—750 KVA Uptegraff 3 ph., 6600-4000.
3—100 KVA Gen. Elec. 1 ph., 22000-6900.
3—100 KVA Gen. Elec. 1 ph., 6900/11950Y 230/460.
1—100 KVA Pittsburgh 1 ph., 2200-220/440.
2—100 KVA Gen. Elec. 1 ph., 2200-110/220.
3—75 KVA Pittsburgh 1 ph., 4000-220/440.
3—50 KVA Westhse. 1 ph., 2200 110/220.

ELECTRIC EQUIPMENT FOR INDUSTRY

LET US KNOW YOUR REQUIREMENTS

60 KW MOTOR GENERATOR SET

1—60 KW Westinghouse Synch. Motor Gen. Set, Type SK Generator for 125 volts D.C. compound wound, 90 HP. Type G Synch. Motor for 3-60-220 volts, complete with semi-automatic control unit.

MILL AND CRANE MOTORS

CO-2011, MDS-1091½, MC-90, CO-1812 MDS-108, CO-2007, CO-1810, 38-B.

230 V.D.C. MOTORS

1—150 HP., W.E. Co., Type SK, 1750 RPM.
1—75 HP., W.E. Co., Type SK, 575/1150 RPM.
2—25 HP., W.E. Co., Type SK, 825 RPM.
6—20 HP., G. E. Co., Type RC, 1150 RPM.
3—15 HP., G.E. Co., Type LC, 300/600 RPM.
3—13½, W.E. Co., Type SK, 730/1460.

20 KW MOTOR GENERATOR SETS

1—20 KW Gen. Electric Ind. Motor Generator Set, 250 volts D.C., 3-60-220/440 volts A.C.

FREQUENCY CHANGERS — TURBO GENERATORS — AC & DC MANUAL MAGNETIC CONTROL — CENTRIFUGAL PUMPS — AC & DC SWITCHBOARDS

FOR DETAILS, WRITE **JOHN D. CRAWBUCK CO.** 714-15 EMPIRE BLDG. PITTSBURGH, PENNA.

REBUILT POWER EQUIPMENT

Available Immediate Delivery

ROTARY CONVERTERS

150 kw., West. 250 v. rpm., 2200 3 ph. 60 cy.

1—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.

1—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

MOTOR GENERATOR SETS

500 Amp. West. Arc Welding M.G. Set 75 v. 870 rpm. dir. con. to 220/550 v. 3 ph. 60 cy.

200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor. Complete.

150 kw. Westinghouse 275 v. 600 rpm., dir. con. 290 HP., 2200 v. 3 ph. 60 cy. Syn. Motor.

125 kw Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction

100 kw. G.E. 550 v. 900 rpm. dir. con. 2200/3/60 Syn. Motor.

50 kw., Westinghouse 250 v. type SK, 1200 rpm., dir. con. 118 HP., 220/440 v. 3 ph. 60 cy. Syn. Motor 70% P.F. complete

25 kw. G.E. 125 v. 1700 rpm. dir. con. to 2200/3/60 1700 rpm. motor.

30 kw. West. 60 v. 1750 rpm. dir. con. 46½ HP 220/3/60 1750 rpm. Ind. motor.

ENGINE GENERATOR SETS

50 kw. 250 V. D.C. International P.D.-80 DIESEL ENGINE.

200 kw. 480 v. 3 ph. 60 cy. direct connected, 300 H.P. Buckeye 4 cylinder vertical Diesel Engine.

225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm. 80% P.F. (Can be reconnected 440 or 220 v.)

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. velted to 110 HP 2 cyl. Bessemer Gas Engine.

SLIPRING MOTORS—3 ph. 60 cy.

No.	HP	Make	Type	Volts	Rpm.
1	1500	Allis Chal.	ANY	2200	485
1	700	G.E.	MT-432	2200	393
1	400	West.	CW	2200/550/220	435
1	400	West.	CW-967A	220/440	1170
1	300	G.E.	I-M	220/440	600
1	260	Burke	EMV-65	220/440	600
3	250	G.E.	I-M	550	600
3	250	G.E.	I-M	2200/220/440	600
3	200	G.E.	I-M	2200/220/440	600
1	200	G.E.	I-M	2200	514
1	200	West.	CW-956A	2200	690
1	150	G.E.	I-M	220/440	900
1	100	West.	CI	220/440	1750
1	75	West.	CI	220/440	860
1	60	Triumph	C-16	220/440	430
2	60	G.E.	MT-536	2200	1150
1	52	G.E.	ITC-5013	220/440	570
2	50	Allis Chal.	ANY	220/440	900
1	50	West.	HF-12A	220/440	900
1	50	West.	CW-461	220/440	900
1	50	G.E.		220/440	850
2	50	West.	HF	220/440	1120
1	50	West.	CW-636A	220/440	1150
2	40	G.E.	MT-332	220/440	1155
1	40	G.E.	MTC-5522	220/440	1125
1	40	G.E.	MT-342	220/440	860
1	40	Allis Chal.		220/440	685
1	40	G.E.	MT-552	220/440	575
1	25	West.	MW	220/440	680
1	25	West.	CI	220/440	870

SYNCHRONOUS MOTORS

4—150 HP. Allis Chal. 2200/3/60 1200 rpm. 70% P.F. 125 v. exciter dir. conn. thru coupling to 4—Falk Reduction Gears, ratio 1200—164 rpm. complete with control.

1—300 HP Elec. Machy. 2200/3/60 72 rpm. 100% P.F.

1—190 HP Elec. Machy. 2200/3/60 90 rpm.

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

SPEED REDUCERS

4—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.

3—2 HP Crocker Wheeler 925 to 73 rpm.

3—7½ HP Crocker Wheeler ratio 50 to 1.

1—150 HP. R.D. Nuttal ratio 1.6:1.

4—150 HP. Falk Co. Reduction Gears, ratio 1200—164 rpm.

1—450 HP. Kerr Reduction Gear, 3800 to 720 rpm.

1—4½ to 7½ HP Link Belt Herringbone ratio 59.4 to 1.

1—30 HP Falk Ratio 15.7 to 1.

TRANSFORMERS—1 ph. 60 cy.

3—1500 Kva. Pittsburgh Transformers. 22,000 volt Primary, 6900/6600/2200 volt secondary.

No.	Kva.	Prl.	Sec.	Make	Ph.
1	220	2300	115/230	All. Ch.	3 ph.
3	150	22000	6000	Pgh.	
1	150	2200	230/460	G.E.	3 ph.
1	100	2200	110/220	G.E.	3 ph.
1	100	2200	110/220	West.	
3	100	6600	550/440/220	Pgh	
1	100	2200	220/110	West.	
2	75	2200	220	Burke	3 ph.
2	50	2300	220/440	G.E.	1 ph.
3	50	11430/6600	550	Al. Ch.	
3	50	6600	575	G.E.	
1	50	2200	220	Burke	
3	50	2200	110/220	West	
5	50	2200	110/220	G.E.	
1	37½	2300	220/440	Wagner	
3	37½	22000	2200	West.	
3	37	4400	185	West. (Rotary)	
1	30	2200	110/220	G.E.	
25	25	2200	110/220	G.E.	
1	25	550	110/220	G.E.	1 ph.
3	25	2200	110/220	Westg.	1 ph.
3	20	2200	110/220	G.E.	
1	20	1100/2200	110/220	Pgh.	1 ph.
10	15	2200	110/220	G.E.	
3	15	2300	220/440	Pgh.	
3	15	2300	220/440	Pgh.	1 ph.
35	10	2200	110/220	G.E.	
40	10	2200	110/220	West.	
100	7½	2200	010/220	G.E.	
50	7½	2200	110/220	West.	
75	5	2200	110/220	G.E.	
50	5	2200	110/220	West.	
7	5	550	110/220	Pgh.	1 ph.
2	5	6600	110/220	Pgh.	1 ph.

AIR COMPRESSORS

2—260 CFM Chic. Pneu. 12x10, 100# pres. 285 rpm. belt driven by 40 HP G.E. AC slipring Motors.

1—485 CFM Ingersoll Rand 14x10, 1 cyl. 60# pressure, belted.

SERIES MOTORS—230 v.

1—175 HP G.E. type MD-109¼ 475 rpm.

5—75 HP G.E. type 211 550 rpm.

1—68 HP G.E. CO-2007, 475 rpm.

1—50 HP Shaw.

1—50 HP West. K-10 (500 v.) 435 rpm.

1—30 HP G.E. CO-2002, 610 rpm.

1—15 HP Crocker Wheeler 270 rpm.

VARIABLE SPEED MOTORS—230 v. dc.

HP	Make	Rpm.	Type
100/125	G.E.	600/720	RC-39
100	West.	1400/1800	SK
100	West.	400/800	SK-180
40	West.	600/1200	SK
30	West.	850/1275	SK
25	West.	600/1200	SK
25	West.	825/1650	SK
20	West.	750/1125	SK
20	West.	575/1150	SK133
15	West.	675/1350	
10	G.E.	455/750	CD-95
10	West.	850/1275	SK
10	G.E.	625/1250	LC
9½/10	West.	565/1130	S
7½/10	G.E.	500/1500	RLC-114
7½	West.	850/1700	SK
7½	West.	475/950	SK
7½	West.	495/990	SK
7½	Cr. Wh.	385/1155	CM
7½	Allis Chal.	350/1050	—
7½	Cr. Wh.	385/1000	CM
7½	Cr. Wh.	385/1000	
7½	G.E.	500/750/1500	RLC
7½	West.	450/900	SK8OL
7½	West.	560/1680	SA
7½	West.	650/1300	SK
5	G.E.	400/800	RC-10
5	West.	400/800	SK
5	West.	450/1800	SK
5	West.	540/1080	SK-60
5	West.	450/1000	SK
5	West.	850/1700	SK
4	West.	500/1000	SK
3½	West.	850/1700	SK
3½	West.	400/1600	SA
3	West.	450/1350	SK
2½	West.	900/1800	SK
2½	Kimball	550/2200	—
2½	G.E.	500/1000	—
2½	West.	600/1200	SK
2½	West.	450/1800	SK
2½	Reliance	225/600	T
2½	West.	450/1800	SK
2½	West.	450/900	SK
2	West.	850/1700	SK
2	West.	1150/2300	SK
2	G.E.	700/2100	CD1-55
2	G.E.	500/1500	
2	G.E.	500/2000	FC-33
½	Northern	700/2100	—

SQUIRREL CAGE MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
500	2200/440/220	West.	CS	720
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
400	2200/440/220	West.	CS	600
350	2200/440/220	West.	CS	450
300	2200/440/220	West.	CS	400
200	2200/440/220	West.	CS	250
200	220/440	West.	CS	580
200	2200	West.	CS	870
150	550/220/440	G.E.	—	575
150	220/440	G.E.	KT-562	690
150	2200/440/220	Al. Ch.	Syn.	1200
125	550/220/440	Al. Ch.	—	1750
100	2200/220/440	G.E.	I-K	600
100	220/440	Al. Ch.	—	1200
100	220/440	West.	—	1750
75	220/440	G.E.	I-K	570
75	220/440	West.	CS	580
60	220/440	Triumph	—	430
60	220/440	G.E.	KT	450
60	220/440	West.	CS	1150
50	220/440	Al. Ch.	—	690
50/100	220/440	West.	CS	545/700
50/32	220/440	G.E.	POS	800/640
50	550/440/220	G.E.	IK	900
50	220/440	G.E.	KT	1155
50	220/440	Reliance	—	1800

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KWA West. 375# I.P. 100# B.P. N-C.
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing.
1— 200 KW Elliott Non-Condensing
1— 187 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
2— 187½ KVA Ridgway slide valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS
1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—200 KW Skinner Uniflow 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1—100 KW Elliott 4-valve 250 V. 3-wire
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—1000 KVA Cooper (gas) 240 V.
1— 400 KW West. (gas) 440 V.
1— 375 KVA Fair.-Morse 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS
4—750 HP Edge Moor 200-lb.
6—600 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
1—512 HP Stirling 200-lb. Stoker
2—490 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
1—400 HP Stirling 200-lb.
1—400 HP B. & W. 160-lb. Stoker
2—357 HP Casey-Hedges 175-lb. Stokers
2—350 HP Stirling 200-lb.
2—302 HP B. & W. 160-lb. Hand Fired
1—300 HP Kingsford 160-lb. Pulverized Coal
2—282 HP Edge Moor 200-lb. Stokers
2—200 HP B. & W. 160-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.
2—800 HP Electric Machy. 6600 V. 450 RPM
1—200 HP General Electric 2200 V. 1800 RPM
1—175 HP General Electric 440 V. 400 RPM
1—175 HP General Electric 230 V. 225 RPM
1—150 HP General Electric 440 V. 164 RPM
2—120 HP General Electric 440 V. 400 RPM
1—100 HP General Electric 4000 V. 900 RPM
1—100 HP General Electric 2300 V. 240 RPM

INDUCTION MOTORS—60 Cy.
2—800 HP G. E. slip ring 2300 V. 300 RPM
2—400 HP G. E. slip ring 3800 V. 1800 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
1—250 HP G. E. slip ring 2200 V. 450 RPM
5—150 HP West. Sq. cage 440 V. 900 RPM

AIR COMPRESSORS
1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. Ing. XRE, 60 cy. motor

OIL CIRCUIT BREAKERS
1— 800 A. 87 KV Am.Br.Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FK036 Outdoor
2— 600 A. 37 KV Condit FO40A Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FK037 Outdoor
6—1200 A. 7.5 KV G. E. FK-132-B Indoor
2— 600 A. 7.5 KV G. E. FK-132-B Indoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA G. E. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G.E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.
1—1500 KW Westinghouse 250 V.
1—1250 KW General Electric, 240 V.
2—1000 KW General Electric, 600 V.
2—1000 KW Westinghouse, 250 V.
2— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS
1—1000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
3— 500 KVA West. 66000/2400 V.
3— 500 KVA Allis 33000/480 V.
1—10000 KVA G. E. 26400 Y/2300 V. 3 ph.
2—1000 KVA G. E. 23000-11500/575 V.
3— 250 KVA G. E. 22000/11000 V.
3— 100 KVA G. E. 22000/6900 V.
3— 100 KVA Allis 22000/440 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
1— 450 KVA G. E. 132000/240-480 V. 3 ph.
3— 200 KVA G. E. 13200/2300-4000 V.
3— 150 KVA Pitts. 13800/230-460 V.
3— 1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
3— 1250 KVA G. E. 6600/550 V.
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3— 1000 KVA Pitts. 2300-4600/550 V.
4— 150 KVA G. E. 2300/115-230 V.
6— 50 KVA G. E. 2400/240-120 V.

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AC TURBINE UNITS
6250 KVA G.E., 2300 V. cond.
3125 KVA G.E. 2300 V. cond.
2500 KVA G.E. 2300 V.—Surface Condenser
1875 KVA Al. Chal. 2300 V. cond.
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., 550° with Surface Condensor.
937 KVA Al. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA Al. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse, 2300 V., with Surface Condensor, etc.
625 KVA Al. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor.
625 KVA Al. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA Al Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor. Condensing or Mixed Pressure.
150 KVA Wghse. 240/480 V., Jet Condensor.
75 KVA Al. Chal. 240-440 V. non-cond.

AC ENGINE UNITS
375 KVA G.E. 22x27 Erie Ball 4 V.
250 KVA G.E. 17x20 Erie Ball 4 V.
250 KVA Al. Chal.-Nordberg Uniflow.
225 KVA G.E.—18x36 Hamilton Corliss.
225 KVA G.E.—15x24 Nordberg Uniflow
187 KVA G.E.—18x21 Chuse Uniflow
150 KVA (2) G.E.—16x16 Skinner Uniflow.
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow

BOILERS (ASME)
950 HP Sterling, 275#
728 HP E.C. Vert. 200#
685 HP Sterling 200#
650 HP Babcock & Wilcox 225#
500 HP (2) Heine bent tube 160#
500 HP Murray (Heine) 200#
420 HP Sterling, 200#

BOILERS
407 HP (2) Erie City, Low Head 250#
320 HP Sterling, 200#
302 HP Babcock & Wilcox, 200#
295 HP (3) Sterling, 200#
270 HP (2) Erie City bent tube, low head. 180 lbs. with pulverizers. (A complete plant.)
253 HP (2) Heine, 160#—cross drum

BLEEDER TURBINE UNIT
625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condensor

GAS & DIESEL UNITS
1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
375 KVA Wghse. 3 ph. 60 cy.; Busch-Sulzer
200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel.

OIL HEATING & PUMPING UNIT
Suitable for 1000 HP to 2500 HP in Boilers

TRANSFORMERS
5—1800 KVA G.E. 3 ph. 14,520-600 V.
1—1250 KVA G.E. 3 ph. 13,200/26400-2300 V.
3—833 KVA Wghse. 22000-2200 V.
2—687 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
3—500 KVA Wghse. 22000-2200 V.
3—333 KVA G. E. 11,000/440 V.
3—300 KVA Maloney 17,500-440 V.
1—300 KVA Maloney 3 ph. 13,200/6600-220/440 V.
6—300 KVA Pittsburgh 22,000-2200/440 V.
2—250 KVA G.E. 6600/5940-2300 V.
3—250 KVA Packard 22,000-2200 V.
3—200 KVA Pitts. 25000-460 V.
4—200 KVA Wghse. 13,200-2300/4000 V.
3—200 KVA G.E. 22,000-2200/6600 V.
1—200 KVA G.E. 13,200-2300/4000 V.
5—200 KVA G.E. 13,200/26,400-2300 V.
5—200 KVA Wghse. 2200-110/220 V.
3—150 KVA Wghse. 11,000/440 V.
3—150 KVA G.E. 13,200-115/230 V.
1—150 KVA Wagner 13,860-110/220 V.
1—150 KVA G.E. 13,800-230/460 V.
3—100 KVA G.E. 13,200/2300 V.
3—100 KVA Al. Chal. 22,000/440 V.
3—100 KVA G.E. 13,200/6600/2300 V.
3—100 G.E. 13,200/460-2300/4000 V.
2—100 KVA G.E. 13,800-115/230 V.
1—100 KVA G.E. 33,000-2300/4000 V.
2—100 KVA G.E. 600-120/240 V.
2—100 KVA G.E. 6600/13,200/11,880-440-606 V.
1—100 KVA Wagner 13,860/220/110 V.
3—75 KVA Wghse. 11,000/440 V.
3—75 KVA G.E. 13,200-115/230 V.
4—50 KVA Wghse. 2200-220/440 V.
3—37½ KVA Wghse. 2300/575 V.

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YOUR IDLE POWER EQUIPMENT CAN BE TURNED INTO
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D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS8-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
4—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
1—	200	Whse.		400/500
1—	150	G.E.	MPC	250/450
3—	150	Whse.	SK-201	300/900
1—	100	Al. Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr. Wh.	65-H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El. Dy.	S	525/1050
2—	50	Cr. Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

SYN. CONDENSER

1—1000 Kva. G.E. 2 units 3 Brg Condenser set with exciter consisting of Cond. 4000 Kva., 13200 volt, 3 ph. 60 cy. with 1150 HP, 13200 v. motor and 100 KW Exciter.

FREQUENCY CHANGERS

1—2500 KW, 3 Brg Whse. consisting of 3650 HP - 6600 V., 3 ph., 60 cy., 300 RPM motor.
3125 Kva—2500 Kw.—2400 V.—3 ph., 25 cy., 300 RPM Gen. with a 2 dir. con. exciters.

1—75 Kw., 3 Brg. GE, consisting of: 125 HP—440 V.- 3 ph.—25 cy., 750 RPM.—Sq. Cg. motor., 94 Kva. - 75 Kw—240 V., 3 ph., 62½ cy., gen.

TURBO GENERATOR SET

1 500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.

1—500 KW, G.E., 625 KVA, 23000 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3- single phase, 33000 v. transformers and panel.

2—1000 KW whse, 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels .

1—750 KW Whse. 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.

1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels.

1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V AC, 6 ph., 1200 RPM

ROTARY CONVERTERS

25 Cycle

3—1500 KW GE 225/275 v. DC Booster type each with 1600 KVA, 3 ph. 6765 volt transformers and panels.

1—500 KW GE 225/275 DC Booster type with 500 Kva 3 ph. 6765 volt transformer and panels.

A C MOTORS

3 phase—60 cycles

Synchronous

	HP	MAKE	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	300	G.E.	ATI	440	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	125	G.E.	ATI	240	257
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	HR	220	450
1—	100	Whse.	G	2300	900

Slip Ring

1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM-17B	2200	290
1—	150	G.E.	MT-564	440	600
1—	150	G.E.	IM	2200	695
1—	150	Whse.	CW-772-S	220	1165

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	580
2—	300	G.E.	1K	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
2—	200	Whse.	CS	2300	1200
1—	200	Whse.	CS	4600/2300	900
1—	200	Al. Ch.		2200	1750
3—	150	Al. Ch.	AN	220/440	1750

RE-NU-BILT BELYEA MOTORS

What are your requirements?
units up to 5000 kw
available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

500	2200–440	G.E.	720
600	2200	Whse.	900
400	440-220	Whse.	76
350	440–220	G.E.	200
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—667 kva., Whse. 22000-2300.
3—500 kva., Whse. 22000-2300.
3—400 kva., G.E. type H, 13200-440.
3—250 kva., Al. Chal. 4150-480.
3—250 kva., Whse. 13,800-460.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva. G.E. 4000-480.
2—150 kva., Whse. 4800/4156/2400-480/240.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva.,Whse. 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse. type SK, 13800-240/120.
3— 50 kva., Whse. 22,600-2300.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.

A. C. GENERATORS

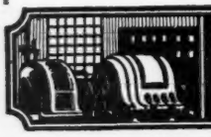
1—500 kva., 900 r.p.m., 2200 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300 V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	600
200	220/440	G.E.	IK	720
150	2200	Allis. Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—100 K.W., 250 V., 1200 R.P.M., Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M., G.E., type RC to 90 H.P., 4150/2300 V., 3 ph., 60 sy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—300 K.W., 250/275 V., 1200 R.P.M. Connected to 450 H.P. 4000/2200 V. 3 ph., 60 cy., syn.



STEPHEN HALL & COMPANY, INC.

458 Seventh St., Hoboken, N.J.

SYNCHRONOUS CONVERTERS

500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
303 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. SYN. 250 V. 2300 A.C. 720 RPM
200 KW G.E. SYN. 600 V. 2300 A.C. 720 RPM
200 KW G.E. IND. 250 V. 440 A.C. 720 RPM
200 KW R.W. SYN. 250 V. 2300/4000 A.C. 900 RPM

TURBO GENERATOR SET

CURTIS Turbine 3600 RPM, Non-Condensing, 100# Steam Pressure. GENERAL ELECTRIC Generator 300 KW, type MPC, 250 V. D.C., 1200 RPM.

Each unit listed above is owned by us and is Available now for immediate purchase.

WALLACE E. KIRK CO.

Incorporated

502 Grant Building Pittsburgh, Pa.

ENGINES
GENERATOR SETS

DIESEL AND GASOLINE

New and Re-built

JOHN REINER & CO., INC.

12-12 37th Avenue

Long Island City, New York

Phone: Stillwell 4-4666

FOR SALE

We offer 523, 55-ton all-steel, self-clearing

DOUBLE HOPPER CARS

consisting of:

160 USRA construction; built 1921-1922; with A-B brakes; 1880 cubical feet capacity. 363 built 1910-1915; with KD-1012 brakes, 1683 feet capacity.

ALL HAVE FULL "U" CAST STEEL TRUCK FRAMES

Purchaser must buy all.

PRICE: $1700.00 each f.o.t. Pennsylvania.

TERMS: Cash with purchase.

DELIVERY CAN COMMENCE IMMEDIATELY AND BE COMPLETED IN ABOUT 60 DAYS—AND VERY POSSIBLY SOONER

Some $30,000 to $40,000 NEW REPAIR MATERIALS also available which you may wish to have inspected at the same time.

TIME and EXPEDITION ESSENTIAL and DESIRABLE.

Yours for Victory,

IRON & STEEL PRODUCTS, INC.

37 years' experience

13488 S. Brainard Ave. **Chicago, Illinois**

"ANYTHING containing IRON or STEEL"

Babcock & Wilcox boilers

Two single set 500 H.P. each, 200#
One single set 400 H.P., 200#
These boilers were designed for burning a low grade fuel having an exceptionally wide furnace.
Prompt delivery, excellent condition.

HARRY BREARLEY

3423 91st Street Jackson Heights, N. Y.

HIGH-PRESSURE BOILERS

"New and Used — NOT Abused"!

JOE SULLIVAN CO.

523 N. Hamlin Ave. CHICAGO, ILL.

Phone—VanBuren 8669

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33 N. SUPERIOR ST.

TOLEDO OHIO

OVER 10,000 ITEMS IN STOCK FOR IMMEDIATE DELIVERY FROM EITHER ROCHESTER, N. Y. OR TOLEDO, OHIO REBUILT AND SOLD WITH A STANDARD NEW GUARANTEE.

The Mark of Dependability

MOTORS, GENERATORS, CONTROLS, TRANSFORMERS, MOTOR GENERATOR SETS, etc.

BERGER BROTHERS ELECTRIC MOTORS INC.

395 STATE ST.

ROCHESTER NEW YORK

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720		K

Compressors in stock up to 300 H.P. Compensators.

WANTED

Write—Wire—or Phone

1—125 or 150 H.P. 230 Volt D.C. Motor, 200/1200 RPM, or any 6—1 ratio. Wire if you have this motor.

MOTOR GENERATOR SETS

1—150 KW Ridgeway, 250 Volt, D.C., 1200 RPM, Direct Connected to 3 PH., 2300 V, Synchronous Motor—Complete.

3—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors. 3/2200/60/1200 complete with panels.

1—100 KW Crocker Wheeler 250 v DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM. complete.

1—75 KW Ridgeway 140 v DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. complete.

DIRECT CONNECTED PUMPS

1—280 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 3 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

2—400 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

3—350 G.P.M. Buffalo Pumps, Inc. 40 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	40	G.E.	25	2200/440
3	50	Whse.	25	2200/110/220
3	50	Whse.	25	11000/2200
3	100	Whse.	60	2200/220/440
3	100	Whse.	60	4600/230/460
3	100	G.E.	25	2200/220/440
3	100	G.E.	25	11000/2200
3	200	G.E.	60	2400/220/440
3	200	G.E.	60	4600/230/460
3	200	G.E.	60	6600/220/440
3	500	Pitts.	25	11500/100
3	1000	Pitts.	60	2300/4600/230/460

FREQUENCY CHANGERS

94 KVA Westinghouse Synchronous Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

1—120 KVA Gen. Elect. Induction Frequency changer, 440 volts 3 ph. 62½ cy. Driving motor 100 HP. 3 PH. 440 volt 25 cycle 720 RPM. Complete.

200 KW, Gen. Elec. 3 ph, 60 cy. 2300 v. direct connected to 290 HP Gen. Elec. Synchronous motor 3 ph. 25 cy. 440 v. complete with panels.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

SLIPRING MOTORS

60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec.(2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West.	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. Elec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4817983	750
40	Gen. Elec.	MT343	3887755	750

SPECIAL

1—20 HP, Gen. Elec. Motor 230 v. DC. Type CD83 1750 RPM.

1—75 HP. Westinghouse Motor Type SK. 230 v. DC 475/950 RPM variable speed.

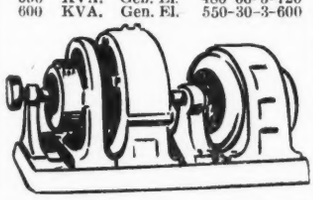
ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

WAR PRODUCTION EQUIPMENT

A. C. GENERATORS

50	KVA.	F.M.	2200-60-3-1200
50	KVA.	Bullock	600-60-3-1200
75	KVA.	Gen. El.	240-60-3-900
75	KVA.	Cr. Wh.	2300-60-3-900
90	KW	Gen. El.	2300-60-3-900
100	KW.	Gen. El.	2300-60-3-900
300	KVA.	Gen. El.	480-60-3-720
600	KVA.	Gen. El.	550-30-3-600



SYNCHRONOUS MOTORS

H.			Type
60	Gen. El.	ATI	4000-60-3-900
70	Burke		440-60-2-1200
75	Gen. El.	TS	440-60-3-900
95	Elec. Mach.		220-60-2-900
100	Gen. Elec.	ATI	2300-60-3-900
120	Gen. Elec.	ATI	2300-60-3-1200
125	Gen. Elec.	TS	4000-60-3-900

D. C. MOTORS

Adjustable Speed, 230 Volt

40—DC Variable Speed up to 10 H.P. All speeds and types.

H.P.			RPM
12	Westghse.	SK	600/900
15	Gen. Elec.	CD	690/1380
20	Westghse.	SK	375/1500
30	Elec. Dyn.		400/1200
30	Westghse.	SA	500/1500
50	West.	SK	500/1500

115 Volt

150	West.	S.	720

230 Volt

100	Gen. Elec.	CD 123	1200
150	Crocker Wh.	CCM	1200

ENGINE GENERATOR

1000 KW, 250 v. Westinghouse Engine Generator Set. Immediate Delivery. Inspections invited.

MOTOR GENERATOR SETS

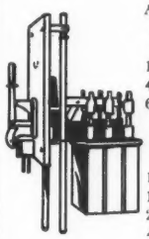
Several small units up to 20 KW. Write for quotations.

20 KW. West. 125 V.	2200-60-3
25 KW. West. 125 V.	220-60-3
40 KW G.E. 240 V.	550-60-3
50 KW. G.E. 125 V.	440-60-3
50 KW. West. 250 V.	440-60-3
75 KW. Ridg. 125 V.	2200-60-3

CIRCUIT BREAKERS

Air and Oil

200—from 60 to 400 Amp. both Air and Oil



3 pole air

Amp	
600	Condit
800	G. El.
1000	West.
4000	G. El.
6000	ITE

3 pole oil

600	G. El.
800	G. El.
1200	G. El.
1500	G. El.
2000	G. El.
4000	G. El.

SPECIAL

3—250 KVA Westinghouse Inerteen (Pyranol) 60 cycle, 1 phase, 600 volt primary, 220-440 volt secondary.

1—100 KW. Westinghouse, SK, factory built. MG set. 250 volt. DC. 900 rpm. comp. int. to 150 HP. West. syn. motor. 2300 v. 60 cy. 3 ph. 900 rpm. on base, with controls.

1—70 KVA. West. 3 bearing MG set AC gen. 220 v. 60 cy. 1 ph. 1200 rpm. 7 pf. motor drive 125 HP. West CS. 440 v. 60 cy. 3 ph. 900 rpm. on base.

D. C. GENERATORS

KW.			Volt	RPM
30	Gen. Elec.	DLC	125	1200
40	Westghse.	SK	250	1800
50	Gen. Elec.	DLC	125	1200
150	Crocker Wh.	CCD late	250	750

A. C. MOTORS

Sq. Cage—60 Cy.—220/440 V.

300—from ¼ H.P. to 40 H.P. All speeds and types.

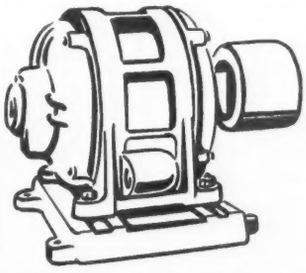
H.P.			
100	Gen. Elec.	KT	1800
100	Gen. Elec.	IK	720
125	Gen. Elec.	KT	900

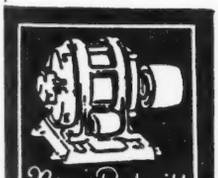
550 Volt

150	Gen. Elec.	KT	1800

2200 Volt

200	Westghse.	CS	1800
200	Gen. Elec.	IK	600





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ELECTRIC EQUIPMENT CO.

678 LAKE AVE. **Phone Glenwood 6783** ROCHESTER, N. Y.

SEARCHLIGHT SECTION

Re-built
Motors and Generators

1—400 HP, **Westinghouse**, type CW, 3 ph. 60 cy. 440 V, 450 RPM slip ring motor.

1—350 HP, **Allis-Chalmers**, 3 ph. 60 cy. 440 V, 600 RPM, slip ring motor.

1—350 HP **Burke**, 3 ph. 60 cy. 440 V, 600 RPM, slip ring motor.

1—300 HP **Allis-Chalmers**, 3 ph. 25 cy. 440 V, 485 RPM, slip ring motor

2—250 HP **Westinghouse**, type CS1012, 3 ph. 60 cy. 440 V, 600 RPM sq. cage

1—200 HP **Westinghouse**, syn. IPF 3 ph. 60 cy. 2200 V, 600 RPM, with direct connected exciter 3 or 2 bearing

2—150 HP **Allis-Chalmers**, 3 ph 60 cy. 440 V, 450 RPM, slip ring

1—200 HP **General Electric**, type 1, form K, 3 ph. 60 cy. 440 V, 450 RPM sq. cage

2—150 HP **Westinghouse**, type CW, frame 1000, 2 ph, 60 cy. 440 V, 450 RPM slip ring.

1—125 KW, **Bullock**, 3 ph, 60 cy, 2200 V, 900 RPM alternator.

2—75R, 2200 V, **Fairbanks-Morse**, 1800 RPM, 3 ph. 60 cy. slip ring motors direct connected to 500 GPM 8 stage 300 head pump

1—50 HP, **Ideal**, type SMS, 3 ph. 60 cy. 220 V, 1800 RPM, syn. DC excitor

1—40 HP **Fairbanks-Morse**, 3 ph. 60 cy. 2200 V, 3600 RPM, type HD. (new)

1—100 HP **Westinghouse**, type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **General Electric**, type CD, frame 123, 230 V, 1200 RPM.

1—100 HP **General Electric** type RF 17 230 V, 400/1200 RPM

1—75 HP **Reliance**, 230 V, frame 985T 400 to 1200 RPM

3—75 HP, **Westinghouse**, type SK, frame, 150, 230 V, 1100 RPM

1—50 HP, **Westinghouse**, type SK, frame 160, 230 V, 565 RPM

1—50 HP **General Electric**, class 5. Form B, 600 V, 600 RPM

1—60 HP **Westinghouse**, type SK, frame 160, 230 V, 680 RPM

1—100 HP **Westinghouse**, type CCL, 3 ph. 60 cy. 220 V, 1750 RPM sq. cage

1—100 HP **Wagner**, type 26V5VBP, 3 ph. 60 cy. 440 V, 860 RPM sq. cage

1—100 HP **Allis-Chalmers**, type ANY, 3 ph. 60 cy. 220 V, 690 RPM slip ring

1—75 HP **Allis-Chalmers**, 3 ph. 60 cy. 440 V, 450 RPM, slip ring

1—75 HP **Westinghouse**, type CW, 3 ph. 60 cy. 440 V, 720 RPM slip ring 3 or 2 bearing.

1—75 HP **Fairbanks-Morse**, type H, frame 165C, 3 ph. 60 cy. 550 V, 900 RPM sq. cage

2—75 HP, **General Electric**, type I, 3 ph. 60 cy. 220 V, 720 RPM, sq. cage

1—75 HP **Lincoln**, type IQ, 2 ph. 60 cy. 440 V, 600 RPM, sq. cage

1—75 HP **General Electric**, type CD, frame 176-550 V, 250/1000 RPM (planer)

2—40 HP **C&C**, 230 V, 250/1000 (Planer)

1—30 HP **C&C**, 230 V, 250/1000 (Planer)

1—20 HP **C&C**, 230 V, 250/1000 (Planer)

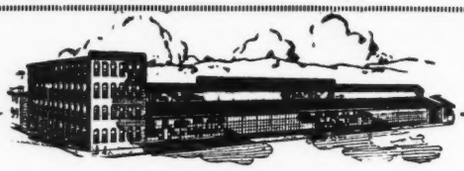
1—10 HP, **C&C**, 230 V, 250/1000 (Planer)

1—7½ HP, **Reliance** 230 V, 250/1000 planer

The Wente Electric Co.

207 N. Fourth St. Hamilton, Ohio

Est. 1903



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120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

•

TODAY'S DEMAND FOR RECONDITIONED EQUIPMENT OBSOLETES OUR STOCK LISTING BEFORE IT CAN BE PRINTED.

Write your requirements for

MOTORS
GENERATORS
MOTOR-GENERATOR SETS
ENGINE-GENERATOR UNITS

THE GLOW ELECTRIC COMPANY

945 HARRIET ST. Phone MA. 3024 CINCINNATI, OHIO

Motor Generator Sets—Synchronous Motors, etc.

MOTOR GENERATOR SETS
3 phase, 60 cycle, A.C.
150 KW West. 275 volt D.C. 2300 volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

VERTICAL MOTORS
1—G.E. 50 HP 1200 RPM 220 Volt
1—Reliance Fan Cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle
2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt

SLIP RING MOTORS 3 phase 60 cycle
G.E. 60 HP 720 RPM 440/220 Volt
Allis-Chal. 250 HP 600 RPM 440/220 Volt

ADJUSTABLE SPEED
220 Volt D.C. Motors
1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
2—Electro Dynamic 60 HP 300/1200 RPM
2—Electro Dynamic 60 HP 450/1200 RPM
1—Electro Dynamic 60 HP 525/1100 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
1—Crocker-Wheeler 125-H 50 HP 175/700 RPM

The Electric Motor & Repair Co., Cuyahoga Falls, O.

FREQUENCY CHANGER

3650 HP., 3 phase, 60 cycle, 6600 volts, 300 rpm, Westgh. synchronous motor connected to a 3125 KVA 25 cycle single or 3 phase, 2300 volt synchronous motor, serial numbers above 8 million can be operated eitherway.

TURBO GENERATORS

1—937 KVA, 750 KW, 3 ph., 60 cy., 2300 V., 3600 rpm Gen. Elec. complete with C. H. Wheeler surface condenser pumps, radiojet.

1—625 KVA, 500 KW, 3 ph., 60 cy., 480 V., 3600 rpm, Gen. Elec. with direct connected exciter.

1—same in 2300 volts.

GAS ENGINE UNIT

1—140 KVA, 98 KW, .7 P.F., 60 cy., 277 rpm, Gen. Elec. with direct connected exciter to 4 cylinder Foos engine. Has gasoline attachment.

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

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Power Plant Valves and Engineering Specialties for Oil, Steam, Gas, Air, Liquids and Chemicals.
Jenkins, Fairbanks, Sarco, Powell Valves and surplus.
Large Complete Stocks ⅛" to 24".
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NOW LOCATED AT OUR NEW PLANT

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COMPLETE STOCK
ELECTRIC MOTORS
GENERATORS M-G SETS
Rebuilt & Fully Guaranteed

ARTHUR WAGNER COMPANY
Electrical Engineers since 1906

POWER EQUIPMENT FOR PROMPT SHIPMENT

SYN. MOTORS, 3 ph. 60 cy.

HP	Make	Volts	Speed
700	G.E.	6600	1800
300	Al.Ch.	2200	600
300	Elec.Mchy	2200	72
190	Elec.Mchy	2200	90
75(2)	G.E.	2200	900
75	Westgh	220	1800

SQUIRREL CAGE MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	6600	1800	
450	West.	2200/220/440	50	CS
400 (5)	West.	2200/220/440	500	CS
350	West.	2200/220/440	500	CS
200	Al.Ch.	2200	600	
150	West.	220/440	580	CCL
125/40	Cr.Wh.	2200	700	125 AQ
125	West.	2200	1800	CS765A
125	Burke	220/440	1200	
125	Cr.Wh.	2200	700	125 AQ
100	Burke	220/440	900	
100	F. M.	220/440	600	BB

SLIP RING MOTORS (3 ph. 60 cy.)

HP	Make	Volts	Speed	Type
700	G.E.	2200	393	MT 432
300	G.E.	440	600	I-M
250	G.E.	2200	600	I-L
200	G.E.	2200	600	I-L
200	Cr.Wh.	2300	440	28
200	G.E.	2200	240	MT 412
150	G.E.	2200	600	I-L
125	G.E.	2200	600	I-L
125	Al.Ch.	2200	435	
100	Al.Ch.	220/440	575	
100	G.E. -25 cy.	220/440	500	MI-108

DC SERIES WOUND MOTORS

HP	Make	Type	Speed
8 (2)	Northern		600
15	West.		650
25	Shaw		600
30	G.E.	CO2002	610
35 (2)	G.E.	CO2507	640
50	Shaw		600
75	G.E.	211 Int.	550
175	G.E.	MDS 190	475

OIL ENGINE DRIVE AIR COMPRESSOR

Chicago Pneumatic simplate valve type NSO3 straight line 16½ & 11 x 18" capacity 492 cu. ft. displacement, 100# pressure, with air receiver and starting air compressor.

M-G SETS 3 ph. 60 cy. (Syn.)

150 KW (2) Ridg. 275 v. DC—2200 v. AC 900 RPM
150 KW West. 550 v. DC—2200 AC 1200 RPM
125 KW Cr. Wh. 250 v. DC—440 v. AC 1200 RPM
100 KW Ideal 275 V. DC—2200 V. AC 1200 RPM
90 KW Al. Chal. 230 v. DC 2200 v. AC 900 RPM

SHOP HOISTS

1—1 Ton Sprague 230 v. DC
1—2 Ton Yale & Towne AC 220/3/60
1—2 Ton Alfred Box AC 220/3/60
4—2 Ton Sprague 230/500 v. DC Monorail
1—4 Ton Sprague 230/500 v. DC Monorail.

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Pittsburgh, Pennsylvania

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Used Electrical Equipment

ALL TYPES AND SIZES

17 Ammeters
12 Regulators
300 Disconnecting Switches
250 Bus Supports
150 Current Transformers
7 Potential Transformers
200 Wattmeters & Watt Hour Meters
74 Cut Outs—Oil Type
46 St. Ltg. Transformers—Type I.L.
40 Oil Circuit Breakers
15 Police Telephones

Other Miscellaneous Items

Write TODAY for listing of Complete Inventory and Prices

DEPT. OF UTILITIES, 920 Park St., Alameda, Calif.

ELECTRIC MOTORS

1—G.E. 500 HP; 439 rpm; slip-ring; Type MT-412; 2200-3-60; #2246938. This is a three bearing unit with adjustable base, complete with starting duty grids; drum type controller; primary oil circuit breaker. **$2500 complete**

1—G.E. 150 HP; 720 rpm; 2200-3-60; Squirrel-cage; Type KT-564; Form BL; #5275874, complete with adjustable base and DEAD front floor type compensator. **$750 complete**

10—G.E. 35 HP; 720 rpm; 440-3-60; Type I; Form K; Squirrel-cage. **$225 each**

1—G.E. 100 HP; 750 rpm; 440-3-25; Type I; Form M; Slip-ring motor only. **$500**

HARVEY DISTRIBUTING CO.
Gardiner, Maine

WATER WHEEL ALTERNATOR

62½ KVA 2300 V Electric Machinery Water Wheel. Alternator complete. 20' head.

MOTOR GENERATOR SET

1—150 KW 275 V Ridgeway direct connected to 225 H. P.—3 ph. 60 cy. 2300 V at 1200 RPM.

MOTORS

1—125 H.P. slip ring G. E. 1200 RPM 2300 V.
2—100 H.P. Squirrel Cage Allis Chalmers 1200 RPM 2300 V.
1—100 H.P. Squirrel Cage G. E. 600 RPM 220-440 V.
1—25 H.P. Squirrel Cage G. E. 450 RPM 220-440 V.
1—250 H.P. C. S. Westinghouse 900 RPM.

A. H. NIMMO ELECTRIC CO. 826 PORTER STREET DETROIT, MICHIGAN

FOR SALE

BOILER

One 200 H.P. 200# per sq. in., H.R.T. Boiler built by Pennsylvania Boiler Works in 1931. Complete with 75 foot stack, safety valves and water column. Retubed April last.

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NONCONDENSING TURBINE

1200 KW 325 lb. 625 deg. 3600 RPM, 16.7 lb. B.P. New 1923.
Had 5 years service. Was connected to generator but no generator now with it.

FS-315, Power
520 No. Michigan Ave., Chicago, Ill.

1—200 HP **Westinghouse Motor,** slip ring, Type M.W. 440 V, 3 ph. 60 cy. 275 amps, 580 RPM. with controlls and base.
1—**Worthington Duplex Pump,** 11 x 14 with 75 HP G. E. Motor, 3 ph. 60 cy. 2200 volts, 720 RPM, capacity 1000 gal per minute, chain drive.

Dayton Steel and Machinery Co.
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BARGAINS

4—500 HP 200# P. W. T. Boilers
2—357 HP 165# P. W. T. Boilers
2—250 HP 165# P. W. T. Boilers
1—75,000 & 50,000 Gal. Tanks & Towers
1—270 cu. ft. Motor Driven Air Comp.
16—10½'x25' Vert. Steel Storage Tanks
1—125 KW 3-Wire DC Gen. & Chuse 4-Val.
1—150, 120, 60 & 25 HP Diesels, Ex. Cond.

H. & P. MACHINERY COMPANY
5819 Enright Ave. St. Louis, Mo.

Electrical and Steam Machinery

TURBINE UNITS (A.C.)

1—750 K.W. **Allis Chal.** 200# steam pressure condensing, with 3 ph., 60 cy., 2300 volt generator, 3600 RPM. Can furnish surface or jet condenser.

1—600 K.W. **De Laval**, 175# steam pressure condensing, 3 phase, 60 cycle, 2300 volt, 3600 RPM. Fitted with additional nozzles for operating under 125# non-condensing duty at rating of 500 K.W.

1—300 K.W. **Gen. Elec.** 200# steam pressure, 450° T.T., Non-Condensing 2 stage, 3600 RPM., 3 ph., 60 cy., 2300 volt, with direct connected exciter.

1—250 K.W. **Kerr-Elliott** turbine, 200# pressure condensing, fitted for mixed pressure operation at 2# low pressure, combined with 250 K.W. Allis Chalmers 3 ph. 60 cy., 2300 volt generator, 3600 rpm. Direct connected exciter.

TURBINE UNITS (D.C.)

1—750 K.W. **ELLIOTT** MIXED PRESSURE TYPE TURBINE, 1800 RPM., direct connected to 750 K.W. 230/240 volt, 3000 Amp. RIDGWAY D.C. GENERATOR, with C. H. WHEELER SURFACE CONDENSER with Pumps, Cooling Tower, Switchboard and Piping.

1—100 K.W. **General Electric** 235/250 volt, 400 amp., 3600 RPM., with Non-condensing type Curtis turbine, 150# steam pressure.

1—35 K.W. **Gen. Elec.** 125 volt, 3600 rpm. condensing operation.

1—35 K.W. **Gen. Elec.** 125 volt, 3600 rpm. Non-condensing operation.

MOTOR GENERATOR SETS.

1—75 K.W. **Gen. Elec.** 125 Volt, 600 Amp. Interpole D.C. generator with 115 H.P. Form K. Induction Motor 3 ph., 60 cy., 220/440 volt, 1200 RPM., self contained.

1—35 K.W. **Gen. Elec.** 125 volt, 280 amp. DLC generator with 50 H.P. Gen. Elec. 3 ph. 60 cy., 220 volt, 1200 rpm. motor.

ROTARY CONVERTERS.

1—1500 K.W. **Westg.** 6 ph. 60 cy. A.C., 250 volt, 6000 amp. D.C., 600 RPM. with 3—550 KVA. transformers stepping down from 2300 volts, and switchboards.

2—1000 K.W. **Westg.** 6 ph. 60 cy. A.C., 250 volt, 4000 amp. D.C., 900 RPM. with 6—350 KVA. transformers stepping down from 2300 volts, and switchboards.

2—750 K.W. **Westg.** 6 ph., 25 cy., 250 volts, 375 RPM with 3—300 KVA. Westg. Air Blast transformers 6600 volts primary to 174 volts secy. and panelboards.

BOILER FEED PUMPS.

1—**Jeansville Iron Works**, centrifugal, three stage, 4" inlet, 3" outlet, driven by 95 H.P. Terry turbine, 2000 RPM., 235# steam pressure, self contained unit.

1—**Cameron** boiler feed pump, 350 G.P.M. at 724' head, 4" inlet and outlet, four stage, driven by 125 H.P. General Electric slip ring induction motor, 3 ph., 60 cy., 440 volts, 1800 RPM. Self contained unit with controlling equipment.

1—30" **Worthington** circulating pump, capacity 19,000 GPM, 20' head with 150 H.P. slip ring 3 ph. 60 cy., 440 volt, 400 rpm. motor.

RADOJET AIR PUMP.

1—**C. H. Wheeler** Twin Radojet Air Pump with inter and after condenser, 2 stage type.

CONDENSERS.

1—935 sq.ft. **C. H. Wheeler** surface condenser, 2 pass type.

1—900 sq. ft. **C. H. Wheeler** surface condenser, 2 pass type.

1—**Schutte & Koertig** Low Level Multi-Jet condenser type #38, suitable for 1000 KW. turbine.

CIRCUIT BREAKERS.

2—**Westinghouse** 600 Amp., 15,000 volt, type C.O. 11. Interrupting rating 310,000 K.V. Rebuilt 3 years ago for use at the New York World's Fair and used only two seasons. Three tank type, mounted upon frame-work and wheels. Solenoid operated. Practically new.

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3—150 KVA. **Pittsburgh** single ph., 60 cy., 13,800 volts primary with taps—460/230 volts secy.

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POWER PLANT EQUIPMENT

TURBO-GENERATORS

1—3000 KW G.E. 600 V. Cond.
1—2500 KW G.E. 2300 V. Cond.
1— 625 KW Terry-Allis—600 V. Cond.
1— 500 KW G.E. 240 V. Cond.
1— 500 KW G.E. 2300 V. Mixed P.
1— 500 KW G.E. 600 V. Cond.
1— 175 H. P.G. E. Turbine—only.

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1—2700 Cu. Ft.—IR—2300 V. Syn. Motor.
1—2588 Cu. Ft.—AIR—Steam Driven. Cond.
1—782 Cu. Ft.—IR—55#.
1—888 Cu. Ft.—IR—2 stage Steam.
1—599 Cu. Ft.—IR—2 stage Belted
2—549 Cu. Ft.—IR—Duplex 25# pressure.
1—146 Cu. Ft.—IR—3 stage Belted 2000#.

G.E. CENTRIFUGAL COMPRESSOR

Type WM—675—8800/10800.
Volume—8800/10800 Pressure 32/39.6.
Driven by 820 H.P. G.E. Turbine.
Condition excellent.

BOILERS

2—300 H.P. B&W 160#.
1— 60 H.P.HRT—125#.

WATER WHEEL GENERATORS

1—312 KVA, 2400 V. connected to Rodney Hunt wheel 17' Hd.
1—625 KVA, Morgan Smith 42' Hd.

BELTED GENERATOR

1—500 KW. G.E. 550 V. 225—RPM.

INDUCED DRAFT FAN

1—126,000 CMF to 210 HP Turbines.
1—165,000 CFM to 450 HP Turbine.

MOTORS

14—Motors, 25 cycle, 440-550 volts. H.P. ranging from 15 to 350.

Also transformers, engines and cranes

Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.
The Buyer Must Be Satisfied—Always

COMPLETE POWER PLANTS

WHAT DO YOU REQUIRE?

SPECIALS

2000 KW Turbo-Generator, 60-3-480 V. Surface Condenser, Reconnect 600 V.—Rewind for Higher Voltages
5000 KW otherwise as above, except 2300/4000
3500 KW Turbo 60-3-2300 V. Jet Cond.
2500 " " " " Surface Cond.
1500 " " " " Jet Cond.
1250 " " " " Jet Cond.
1000 " " " " Surface Cond.
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Boilers 4—1000 HP, 4—600 HP., 2—500 HP., 4—560 HP.

Also Smaller Water Tube & Fire Tube Boilers

CHARLES B. REARICK **30 Church St., New York**

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ROTARY CONVERTER

1—3500 KW, G.E. Synchronous Booster type 250/310 volts D.C. with a 3800 KVA, 6600/10,900/12000 volts 3 phase, rotary converter type transformer.

TURBO GENERATOR

1—350 KW West. 2300 volt. Non-condensing.
2—400 HP used for three years, good for 125 to 165 lbs. and 7 lbs. back pressure.
1—1000 KW West. Condensing 2300 V.

BOILERS and STOKERS

6—400, 500, 600 and 750 HP. Taylor Retort Stokers.
3—520 HP. B & W Superheaters and Stokers.
5—604 HP. Babcock & Wilcox 200 lbs.

We specialize in high pressure boiler fittings, Boiler-Supports Superheaters pop safety valves, blow-off valves, steel headers, steam valves up to 600 lbs. up to 24" in diameter, turbine and motor driven boiler feed boilers—high and low pressure pumps.

We make up AC. and DC. switchboards.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, heat element, etc.

We also buy complete plants outright. What have you for sale?

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Telephone Nos. Worth 2-2708—2709—2710.

TURBO UNITS

3000 kw A.C. Condensing
300 to 1200 kw A.C. Non-Condensing

BOILERS

Diesel Units (all sizes)

STEPHEN A. DOUGLASS CO.
630 Fort Washington Ave., New York, N. Y.

Direct Current Generators

1—40 KW C-W Type CCD. 250 v., 1100 RPM.
1—45 KW C-W Type CCD. 250 v., 1100 RPM.
1—25 KW GE Type 250 v., 900 RPM Generator.
1—5 KW GE Type CD 250 v. M G. Set.
1—45 KW GE Type ATB Form P.B. 350 v., 3 ph. Alternater.

MILTON WERBY & CO.
423 Atlantic Ave. Boston, Mass.

BOILERS

NEW and USED!

All makes & sizes for prompt shipments

1—525 H.P. 200# Springfield Cross Drum Boiler.
4—500 H.P. Stirling 160#.
3—300 H.P. B. & W. 160#.
6—500 H.P. Edge Moor 200#.

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

COMPLETE POWER PLANT

BOILERS

6—84"x19'6" H.R.T. Boilers, 3" Tubes

2—72"x18'8" H.R.T. Boilers, 3" Tubes

(The above hand-fired with shaking grates)

GENERATORS

1—500 K.W. Generator, single cylinder engine

1—1000 K.W. Generator, twin cylinder engine

1—1500 K.W. Generator, Cross Compound nonconds. Engine

(each with panel boards and instruments)

SUBSTATIONS

7—Rotary Converter Substations complete
2—500 K.W. 5—300 K.W.

MOTOR

1—200 H.P. Synchronous Motor 500 R.P.M. with starter
All A.C. Electrical equipment, 25 cycle, 3 phase, 6600 Volts
All D.C. Electrical equipment, 250 volts

DUPLEX PUMP

1—10x6x10 Worthington Duplex Piston Pump
1—7x9x8 Sullivan Air Compressor and tank with air piping

PIPING, VALVES AND FITTINGS

1—25 K.W. Engine Generator Set, 250 Volts, D.C.
1—75 K.W. Westinghouse Turbo Generator, 250 Volts, D.C.

ALL THE ABOVE IN SERVICE UNTIL APRIL 1942

TURBO GENERATOR

1—625 K.V.A. G.E. Condensing Turbo Generator, 60 cycles, 3 phase, 2300 V.

BOILER

1—406 H.P. Titusville 3-drum Water Tube Boiler, 160 lbs. Penna. Code

JAMES T. CASTLE

424 FIRST AVENUE, PITTSBURGH, PA.

RECONDITIONED ELECTRICAL EQUIPMENT

SYNCHRONOUS MOTORS

KVA	Make	Type	Volts	RPM	Ph.	Cy.
50	GE	ATB	220/440	1200	3	60
75	FW	VRN	220	1200	3	60
100	CW		240	900	3	60
130	GE	ATB-PB	220/440	600	3	60
150	GE	ATB-PB	2300	900	3	60
300	GE	ATB	600	600	3	60

DC 115 AND 230 VOLT

HP	Make	Type	Volts	RPM
100	GE	RC34 Comp	230	1700
125	GE	CO1832 Series	230	675
100	GE	CO1831 Series	230	675
75	GE	RC33 Comp	230	1700
50	GE	CO1810 Series	230	725
50	GE	CO1829 Series	230	750
50	WEST	K10 Series	230	475
30	GE	RC33 Comp	230	775
27	GE	HK107 Shunt	230	3600
30	WEST	SK90 Shunt	230	1700
20	CW	CMC Shunt	115	1700
20	WILSON	Shunt BB	115	1700
15	CW	CCM Shunt BB	115	850

SLIP-RING MOTORS

HP	Make	Type	Volts	RPM	Ph.	Cy.
250	AC		220	600	3	60
200	GE	1M	440	600	3	60
150	GE	1M	2200	720	3	60
150	GE	1M	440	600	3	60
75	GE	MT547	220	1200	3	60
75	GE	MT343	220	1700	3	60
75	GE	MT343	440	1200	3	60
60	IDEAL	AVA351	440	600	3	60
50	GE	MT552	440	600	3	60

SQUIRREL CAGE MOTORS

HP	Make	Type	Volts	RPM	Ph.
200	GE	1K	440	900	3
200	GE	1K	440	600	3
150	GE	1K	220	600	3
150	CW		2200	600	3
150	GE	1K	550	720	3
125	CW		2200	600	3
100	CW		2200	900	3
100	GE	1K	440	360	3
75	GE	KT543	550	1200	3
75	GE	1K	440	360	3

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Benjamin's for Motors, Inc.

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Immediate Shipment!

1 200 KW **Westg. Syn. Motor Generator Set,** 600 V. D.C., Gen., connected to 290 H.P. Synch. motor 3/60/2200 and 900 RPM, with exciters and controls

1 1000 KW **Turbine type Generator,** 3/60/2300 3600 RPM, Type ATB 2

4 50 H.P. **G.E. Unused** Slip Ring Type MTC **Hoist and Crane Motors,** 600 RPM, 3/60/440, type MTC 5542.

4 50 H.P. NEW **Allen-Bradley Reversing Type Controllers,** self-contained, 3/60/440 V.

1—50 H.P. & 1, 100 H.P. **Electric Solenoid Brakes,** 3/60/440.

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37 YEARS' EXPERIENCE

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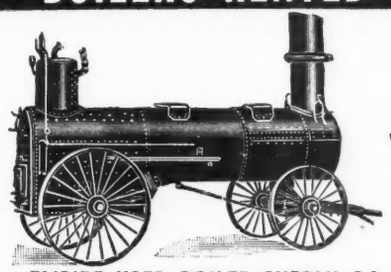

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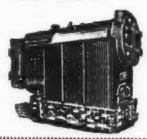

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59 FLUSHING AVE. MAIN 4-5880 BKLYN, N. Y.

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80 H.P. Erie Economic, 100 lbs.
50 H.P. Erie Economic, 100 lbs.
70 H.P. Hamburg Vertical, 114 lbs.

All above complete with regular steam trimmings

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148 N. 3d ST. PHILA., PA.

STEAM GENERATING SET

125 KW 3 Phase, 440 Volts, direct connected to Chuse Horizontal Steam Engine, with Governor Switch Board, Exciter, etc.

SYNCHRONOUS MOTORS

2—275 hp.—600 RPM 440 Volts—7% P.F. G.E. Type ATI 3 Bearing Synchronous Motors with Starters

Reconditioned and Guaranteed

IMMEDIATE DELIVERY

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Phone—Sutter 3943

1—DC GENERATOR SET

Gasoline-driven

Star Generator: 28 V, 400 amp. SB20-W
Engine: Buffalo, Type BA.
Complete with Panel.

1—AC GENERATOR SET

Gasoline-driven

Westinghouse Generator: 48 KVA, 3 phase, 120/240/480 V; 28 KVA, single phase, 120/240 V, 117 amp., 1800 rpm, 60 cyc., direct connected exciter.
Engine: Continental, 6 cylinder gasoline engine, complete with Switchboard with Circuit Breaker, Voltmeter, ammeter and Silverstat Regulator.

Electric Apparatus Repair Co.

1410-12 North Sixth Street Phila., Pa.

DIRECT CURRENT UNIFLOW ENGINE GENERATOR SETS

1—100 KW G.E. Generator Type MPC-6-100, 260 RPM, Frame LD, 400 Amps. 250 V., Ser. #998963. Dir. Con. to Skinner Engine #9752, 14x16. Right hand automatic Universal Uniflow Engine. New 1919.

1—200 KW Sprague G.E. Generator Type S, 200 RPM, 800 Amps., 250 V., Ser. #212323. Dir. Con. to Ames Iron Works Engine #41650, 19x24. Right hand automatic Uniflow Engine. Frame No. M-2. New 1918.

Philadelphia Transformer Co.

2829 Cedar St. Phila., Penna.

SEARCHLIGHT SECTION

1—1000 HP **Badenhausen Riley** 200# **Boiler** with pulverizer.
5—512 HP **Stirling,** Class S-26, 200#.
1—451 HP, 160# pressure, **B.&W. sectional header.**
6—600 HP **B&W boilers,** 200# pres. with stokers.
1—955 HP **Stirling,** 275# pressure.
1—2100 HP **Badenhousen,** 400 pounds pressure, with pulverizers.
3—300 HP **Erie City bent tube boilers,** with type E stokers 180# pressure.

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1—200 HP **Scotch Marine** 150# pressure boiler.
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